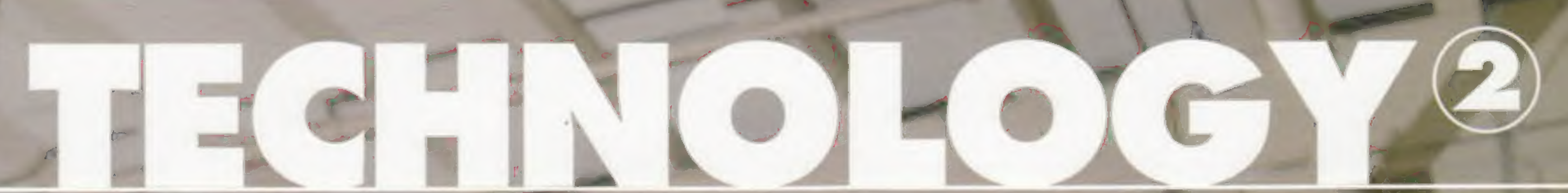
OXFORD ENGLISH FOR CAREERS

Student's Book



Eric H. Glendinning and Alison Pohl

Get ahead in technology

In this unit

- reading for information and exchanging information with others
- speaking about course components
- *-ing* form and *to* infinitive after certain verbs
- ordering and delivering a short talk

Reading

Studying technology

1 The texts describe different ways of studying technology. Work in groups of three. Read one text each and note the information.

1. Which way of studying technology does your text describe?
2. Why did the student choose this way?
3. What kind of courses do the students take?
4. How long does it take to complete their study?
5. What kinds of jobs can they do when they complete their studies?

2 Now find out from the others in your group about the texts they have read.

A University

Cristina is a second-year student of Electronic engineering at university. She decided to study at university because she wants the best choice of career and because she's interested in doing research in digital communications in particular. Most degrees take three years to complete, but some take up to five years because they include periods of work experience.

Degrees may have a broad focus, for example Electrical engineering, or focus on a specialized area, such as Power and High-voltage engineering. Cristina's course is broad-based to start, but she can specialize in digital communications later. Engineering can be studied in combination with other subjects. Cristina is taking German because she wants to spend six months in a German telecommunications company. This work experience will earn her credits towards her degree.

There is a wide career choice for graduate Engineers in design, production, quality assurance, and other fields. They may also work in marketing or become managers.

Cristina hopes to become a Research Engineer, finding new and better ways of doing things.

B Technical college

Okan is a first-year student at a technical college. He chose to study full time because he wanted to get a qualification before he started work. He thinks that being at college will give him more time to decide exactly which career he wants to follow and that having a qualification first will help him to get the kind of job he wants.

Colleges offer a wide range of vocational qualifications. Courses combine applied science, practical skills, and technical know-how. An Electronics Technician, for example, studies physics to understand the principles of the subject, learns how to find faults in equipment, and acquires a great deal of knowledge about electronic devices and components. Courses also include Communication skills to help students deal with communication at work and with the public.

College courses may take a year for a certificate and two years for a diploma. When he graduates, Okan can start work as a Technician or go on to further study at university.

C Apprenticeship

Alessandro has just started as an apprentice Aircraft Fitter with a large defence industry company. Apprenticeships are a way of combining work with practical training. He chose an apprenticeship because he wanted to leave school and start working and earning money as soon as possible.

Today, apprentices combine work, on-the-job training, and part-time study on a day-release basis at a local college, paid for by their employer. Apprenticeships last from one to three years. In Alessandro's case, over the next two years he can obtain vocational qualifications to become a skilled Technician. He can also study to obtain entrance qualifications for higher-level studies so he can go on to become an Aeronautical Engineer.



Gadget box

Moodle is a course management system (CMS) – a free, Open Source software package designed to help educators create effective online learning communities. The Moodle approach to education emphasizes that learners (and not just teachers) can contribute to the educational experience in many ways. What software packages do you use in your learning?

Problem-solving

1 Work in pairs. List the questions you expect to find answered in a description of a course in a college prospectus.

EXAMPLES

Which subjects will I study?
How much will this course cost?
How long will the course last?

2 Now study the course description. Each section begins with a question, as in the examples. Fill in the questions.

3 With the help of the text, explain these terms.

1 vocationally-focused
2 conventional entry requirements
3 work-based learning
4 prior knowledge
5 in-course assessments
6 sustained growth

COMPUTING – WEB TECHNOLOGIES

Foundation Degree – Level 4 – Part Time

1 ***What does this course involve? / Who is this course for? / What are the course aims?***

This course is a vocationally-focused higher education qualification. It provides the high level of technical skills that will be needed by many organizations. Foundation Degrees are designed for learners from a wide range of backgrounds, including those who have work experience but do not have conventional entry requirements.

2 ______________________

The Foundation Degree in Computing (Web Technologies) will include IT Applications (Access and Excel), System Design, User Support, and Professional Studies. Additional modules enable particular specialisms to be developed. These include Website Development, Visual Programming, Database Systems, Networks and Communications, and Website Management.

3 ______________________

The course is delivered using tutor-led classes, workshops, practical sessions, and tutorials. Additional support is given when requested.

4 ______________________

For the two-year course: students must have at least one year of experience in related employment and an employer who is willing to support them by providing suitable work-based learning projects and academic monitoring. Prior knowledge of computing is helpful but not essential.

5 ______________________

The programme of study requires you to study twelve modules over two or three years.

6 ______________________

Studying over two years requires attendance for one day per week from 9 a.m. till 9 p.m. with breaks.

7 ______________________

All units are assessed and graded. Most units involve in-course assessments. Systems Design and Networks and Communications are assessed by examination. To be awarded a Foundation Degree, you must pass a minimum of ten modules.

8 ______________________

Further study:
The Foundation Degree in Computing (Web Technologies) has been designed to enable successful students to progress to the final stage of the University's Honours Degree in Computer Studies should they wish to do so. This would involve just one more year of full-time study or two years of part-time study.

A career:
A Foundation Degree opens up the possibility of a career in a wide range of areas throughout commerce, industry, entertainment, and the public sector. There is sustained growth in employment prospects for all IT specialists.

It's my job



1 Before you listen to Stuart Cole, an Engineering Apprentice, look at **C** in *Reading* on p.5. Try to predict the answers to these questions.

1 How does he spend his working week?
2 How long will his apprenticeship last?
3 What sorts of skills will he acquire?

2 🎧 Now listen and check your answers.

3 🎧 Listen again and answer these questions.

1 What does Stuart's company make?
2 What stage in his apprenticeship is Stuart at?
3 Why is there a lot of paperwork?
4 Why do you think he has two days a week at college now?
5 When does he study?
6 How much studying does he do?
7 What are the attractions of becoming a team leader?

4 🎧 Work in pairs. Listen to what Stuart says in the last section of the recording (from 'I like learning ...'). Help each other to make a complete and accurate version. Then compare with the *Listening script* on p.124.

• Language spot

-ing form and *to* infinitive

• Study these examples:

*She started **working** and **earning** money.*
*He's interested in **doing** research.*
*Research Engineers find new and better ways of **doing** things.*
*She wanted **to leave** school.*
*He wanted **to get** a qualification.*
*He decided **to study**.*

• We use the *-ing* form after prepositions and after certain verbs, for example:

avoid	*keep (on)*	*suggest*
enjoy	*practise*	
finish	*stop*	

• We use the *to* infinitive after certain verbs, for example:

afford	*decide*	*mean*
aim	*hope*	*promise*
choose	*learn*	*want*

• With some verbs, we can use both the *-ing* form and the *to* infinitive with little change of meaning, for example:

begin	*intend*	*prefer*
continue	*like*	*start*
hate	*love*	

» Go to **Grammar reference** p.114

1 Fill the gaps from an interview with an apprentice. Use the correct form of the verbs in brackets.

1 I didn't enjoy _______________ (study) very much.
2 But I was always good at _______________ (work) with my hands. I enjoyed working on motorbike engines.
3 I learned _______________ (repair) electrical equipment with my father's help.
4 He suggested _______________ (take) a course at college.
5 But I wanted _______________ (start) work as soon as possible after school.
6 I decided _______________ (apply) for an apprenticeship with a local company.

Scientists investigate that which already is. Engineers create that which never was.
Albert Einstein

2 Use the correct form of the verbs to complete the gaps in these sentences about jobs in technology.

become	do	measure
connect	maintain	repair
cut	make	transfer
design	manufacture	turn

1 Maintenance Technicians are responsible for ______________ and ______________ equipment in a factory.
2 Estimators calculate the costs of ______________ and ______________ a product.
3 Research Engineers find new and better ways of ______________ things.
4 Fitters are responsible for ______________ new equipment to the network.
5 Design Engineers aim ______________ ideas into plans.
6 Control Engineers attempt ______________ and regulate all the variables in a system.
7 Production Engineers plan ______________ things in the most efficient way.
8 They look at ways of ______________ production costs.
9 Some Engineers decide ______________ to marketing.
10 Others choose ______________ managers.

Vocabulary

Word families

Fill in the missing words. All the words are used in this unit.

Verb	Adjective	Noun
transmit	–	
perform	–	
propel	–	
–		electricity
install	–	
	–	regulation
develop	–	
maintain	–	
specialize	–	
qualify	–	
–		medicine
–		environment

Pronunciation

Unstressed syllables

Study the *Glossary* entry for the word *environmental* on p.132. In addition to giving its meaning, it tells you how to pronounce the word. The stressed syllable of the word comes after /ˈ/. When we stress a syllable, we say it more clearly; we take a little longer to say it and we pronounce the vowel sound fully.

1 Listen to the nouns in the completed *Vocabulary* table. Mark the stressed syllable in each word with a /ˈ/. Note that sometimes the stressed syllable shifts in related verbs, nouns, and adjectives. For example:

mechanic /məˈkænɪk/ *mechanism* /ˈmekənɪzəm/

2 In unstressed syllables, the vowel sounds are weak. In the *Glossary* these are marked with /ə/. This is one of the commonest sounds in English. Note the /ə/ sound in *environmental*:

/ɪnˌvaɪrənˈmentl/

Listen to the nouns in the *Vocabulary* table. Underline the weak /ə/ vowel sounds.

Checklist

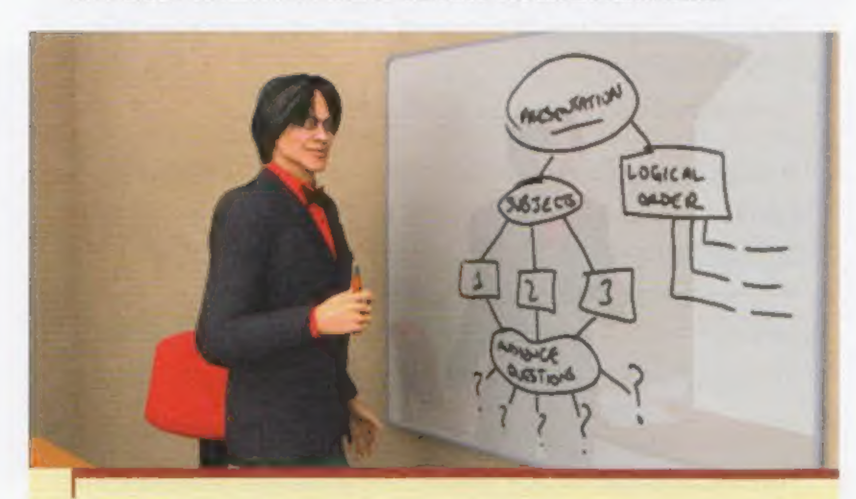
Assess your progress in this unit. Tick (✓) the statements which are true.

- I can use the *-ing* form and *to* infinitive after certain verbs
- I can work out the meaning of words from context
- I can recognize the difference between stressed and unstressed syllables
- I can order and deliver a short talk
- My reading and listening are good enough to understand most of each text in this unit

Make your point

Ordering a presentation

The first step in preparing any talk is to make notes of the things you want to say and to put these notes in the best order. Read the advice from Lee Avatar.



- Note down what your audience wants to know or needs to know about the subject.
- Sometimes it helps to make a set of questions you intend to answer for your audience. Each of your points should help to answer these questions.
- Arrange your points in a logical way that your audience can follow. Don't jump from one point to another in a haphazard manner.
- Give examples to help your audience understand your points.

1 Decide what is the best order to present these points in a student talk on hybrid cars.

a Why are hybrid cars becoming popular? _____

b How is the battery charged? _____

c What is a hybrid car? _____

d When are both the engine and motor used? _____

e The future of hybrid cars _____

f When is the petrol engine used? _____

g Some popular makes _____

h The two basic types _____

i When is the electric motor used? _____

2 Now make notes about your course for a one-minute talk. Practise your talk in a group of three. Ask the other students at least one question after their talks.

Key words

Adjectives
aeronautical
environmental
skilled

Nouns
apprentice
degree
know-how
marketing
media
paperwork
production costs
qualification
quality assurance
work experience

Verbs
earn money
find faults

Note here anything about how English is used in technology that is **new** to you.

2 Food and agriculture

Switch on

1 Look at the pictures of some famous agricultural inventions. Match the pictures A–D with the inventions 1–4. What do you think they were used for? Which one do you think was invented first?

1 barbed wire (invented by Joseph Glidden)
2 cotton gin (invented by Eli Whitney)
3 reaper (invented by Cyrus McCormick)
4 seed drill (invented by Jethro Tull)

2 Read the texts and write the name of the invention on the lines.

1 ____________

This mechanical device removes the seeds, hulls, and other small objects from the fibres, a process which had been very labour-intensive before. The invention of this implement quickly led to further industrial inventions for producing fabric, such as spinning and weaving machines.

2 ____________

As the American frontier moved westwards during the 19th century, there was a shortage of wooden rails and stone. As a result, there was a need for an alternative material for fencing structures. This material allowed large areas of land to be divided into fields.

3 ____________

When seed was scattered by hand, it was often eaten by birds or failed to germinate. This horse-drawn machine made a hole and planted seeds automatically in straight rows, so reducing the amount of waste.

4 ____________

This machine for harvesting was the first step in the mechanization of farm work. The first version cut standing grain mechanically, and two men swept the grain into piles. It was five times faster than cutting by hand. A more advanced machine could also tie the grain into bundles. It was eventually replaced by the modern combine harvester – operated by only one person.

• Language spot

Past Simple v Present Perfect

• Study these examples from *Switch on*. What tense is used?

*When **did** Jethro Tull **invent** the seed drill?*
*The American frontier **moved** westwards during the 19th century.*
*Seed **was** often **eaten** by birds. (passive)*

• We use the Past Simple to ask questions with *What time?* or *When?*, and to make statements about when things happened. These are common past time expressions we use with the Past Simple:

when	*during the 19th century*	*in 1793*
200 years ago	*the last century*	*yesterday*

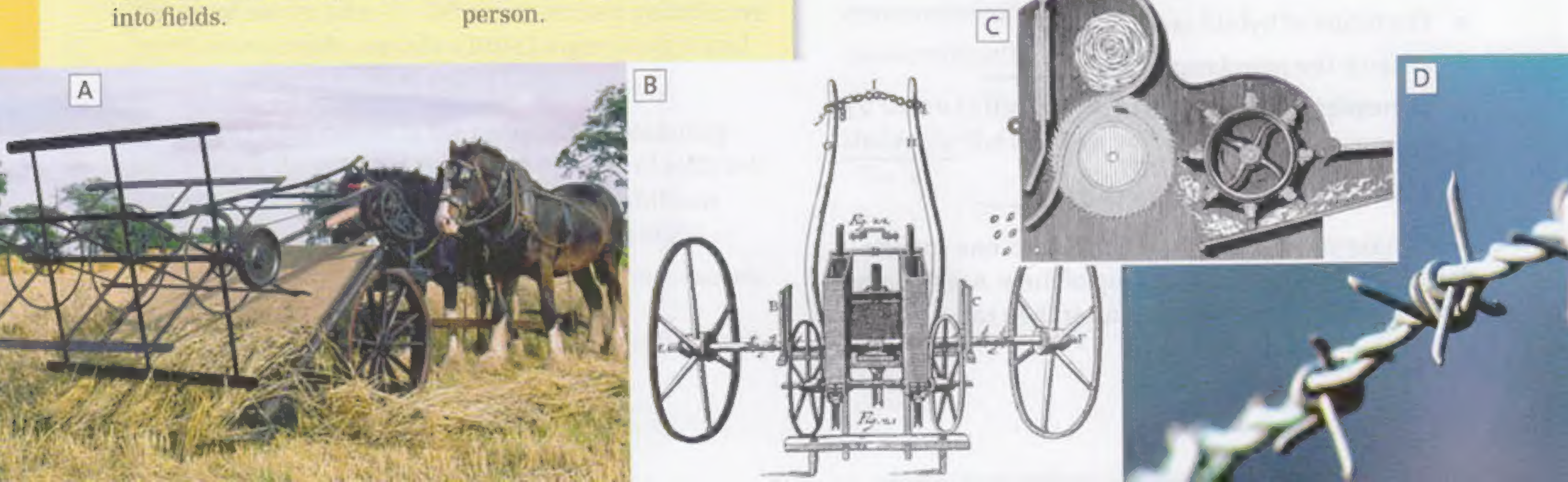
• We use the Present Perfect Simple, often with *since* or *for*, for actions which happened during a period from the past to the present. We also use it for past events when no specific time is given or when the time is unimportant, or to show that the event is relevant now.

*Over the years there **have been** many similar inventions, but this one **has been** the most popular.*
*The same principle **has been used** in machines ever since. (passive)*

• We use the Present Perfect Continuous to emphasize the activity itself. The activity may or may not be complete. We use the Present Perfect Simple to answer *How many?* or *How much?*

A *They've **been harvesting** wheat for the last three days.* (The fields are looking bare.)
B ***How much** grain have they harvested?*
A *They've **filled** five silos.*

» Go to **Grammar reference** p.114



In this unit

- studying the impact of agricultural inventions and developments
- Past Simple v Present Perfect
- how to begin a presentation
- scanning a text for required information

1 Complete the text about the history of tractors. Put the verbs in brackets in the correct tense, Past Simple or Present Perfect Simple, active or passive.

> Tractors ______________[1] (use) on farms since the start of the twentieth century. The first mechanical implements ______________[2] (draw) by horse. Around 1920, petrol-engined tractors ______________[3] (begin) to replace the horse. These early tractors ______________[4] (pull) implements from a drawbar. Around 1940, tractors ______________[5] (begin) to use a hydraulic lift system. In addition, it ______________[6] (be) possible for farmers to use a power take-off shaft for trailed implements, such as manure spreaders. Since the early 1950s, there ______________[7] (be) many improvements in design. There ______________[8] (be) changes in the tractor cab, making it safer and more comfortable. Computer systems ______________[9] (make) it possible for farmers to check on operations. The engine power for tractors ______________[10] (increase) over the years. For many years it ______________[11] (be) 20–40hp, but it ______________[12] (rise) to over 120hp, and sometimes over 200hp.

2 Use the notes to write sentences in the Present Perfect Simple or Present Perfect Continuous.

1. He / work / on this project / since joining the company.
2. How much field data / you / collect?
3. Erik and Al / study / agriculture / for two years and they are really enjoying it.
4. They / design / a robot system to kill weeds and they / demonstrate / it to potential manufacturers over the last few weeks.
5. Since the 1980s manufacturers / made / a number of improvements in design.
6. They / not / use / this machine for long. They still need some time to get used to it.

Listening

Precision agriculture



1 Look at the pictures. What do you understand by the term *precision agriculture*?

2 🎧 Listen to Barry Stones, an Agricultural Engineer, talking about precision agriculture and see if your ideas were right.

3 🎧 Listen again and answer the questions.

1. What sorts of variations could there be in a field?
2. Why is it not a good idea to apply chemicals to a field uniformly?
3. In what ways can information about the field be collected?
4. What example does Barry give to show the savings that can be made?

4 Note the advantages and disadvantages of the two systems for collecting information. Then listen again to complete and check your answers.

	Advantages	Disadvantages
1		
2		

Otto Rohwedder was the only person who saw the point of sliced bread. He spent years trying to devise a system for holding the slices together after they were cut. His first invention used hairpins. In 1928 he finally succeeded, and only a few years later, 80% of all bread sold in America was pre-sliced.



Pairwork

1 Work in pairs, A and B. Each of you has a short text about technology used in fruit production. Read your text and then answer the questions.

1 What is the technology used for?
2 What equipment is used?
3 What does it measure?
4 How has this technology benefited the growers?

Student A Go to p.110.

Student B

In the past, the only way to test the sweetness or firmness of fruit, such as apples, peaches, and apricots, was to select samples of the newly-harvested fruit and eat them! Farmers assumed that if they used this type of destructive testing on a few fruits, they would know about the condition of all the others in the batch. Now, every individual fruit can be tested using non-destructive technologies to grade and sort them. Imaging spectroscopy or multispectral imaging can measure the sweetness and firmness of fruit. An optical detector fuses four laser beams, each at a different waveband of light, into one. An imaging spectrograph, a digital camera, and a computer analyze the amount of laser light that is absorbed by the fruit. This indicates the sweetness of the fruit, while the firmness is measured by the amount of light bounced back.

This technology has many other applications in industry and in space exploration, but in the fruit industry it is used to sort fruit just after it has been picked.

2 Ask your partner the same questions about his / her text and make notes.

3 Read your partner's text and check your notes.

Problem-solving

1 Work with a partner. Use the words to fill the gaps.

activity conditions destroyed disease

The principle behind food preservation is to slow down the __________[1] of bacteria which could potentially cause __________[2], or to kill bacteria completely. In addition, enzymes which cause food to discolour or decay can be __________[3] in certain food preservation methods. Preservation modifies the __________[4] which favour bacteria or enzyme activity.

2 With your partner match pictures A–G with the food preservation methods 1–7.

1 refrigeration and freezing
2 canning and sealing
3 dehydration
4 salting
5 pasteurization
6 fermentation
7 chemical preservation



C









3 Match these principles with the one of the methods in **2**.

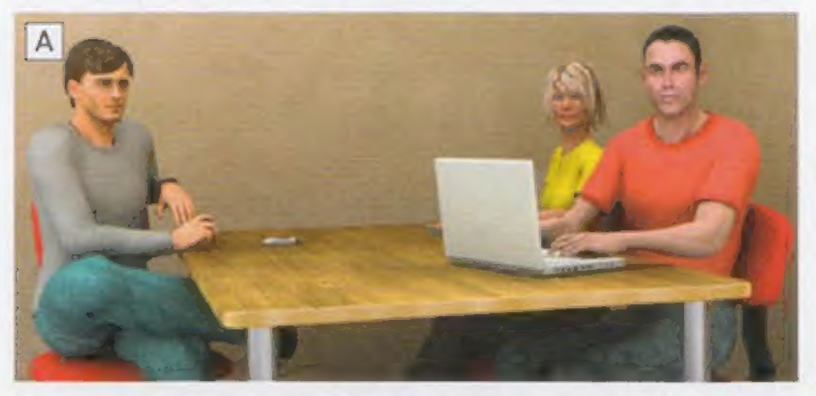
a Benzoates, nitrites, or sulphites either stop bacterial activity or kill bacteria.
b Yeast produces alcohol, which kills bacteria.
c Sodium chloride draws out the moisture and creates conditions which are not favourable for bacteria.
d Cool conditions slow the activity of bacteria, while very cold conditions make bacteria totally inactive.
e Boiling food and sealing it in a container with no air destroys any bacteria already present and prevents any more entering.
f Boiling to between 62.8C and 72.8C destroys some bacteria and disables certain enzymes.
g Bacteria die or become inactive in dry conditions.

Make your point

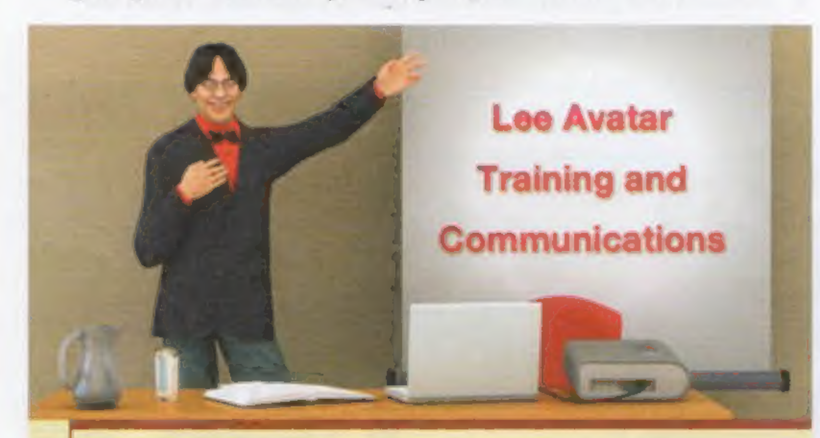
Beginning a presentation

As an expert in your technical field, you will have to present technical issues, often to people who do not have a technical background.

1 Work in pairs. Listen to Lee Avatar talking about preparing a presentation. Match the pictures with some of the points Lee makes in his talk. Explain what each one represents.



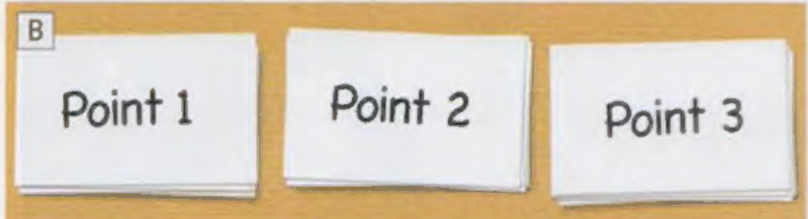
2 Work in small groups. You have to give a presentation to a group of visitors about the town where you live. Practise giving the introduction to the others in your group. Use Lee's *Useful language*.



USEFUL LANGUAGE FOR THE INTRODUCTION

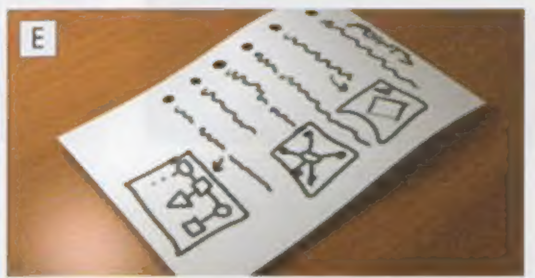
Good afternoon.
Hello. It's good to see you (all).
My name's ... and I'm ... (job title).
I'm ... and I work in the ... department.
I'd like to explain how ... works.
I'd like to give you some information about ...
First of all, we'll look at ..., and then ... Finally, ...
If you want to ask me any questions, please interrupt.
I'll explain first of all and then you can ask any questions at the end.
I'd like to ask you to keep any questions until the end.

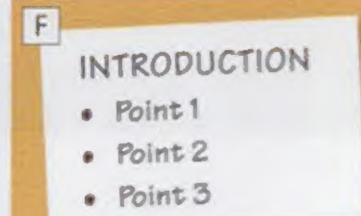
3 When you have finished, discuss the good points of each other's presentation. Think of ways you could improve it.

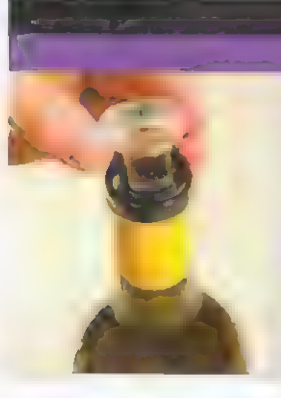












Gadget box

The German company Alcoa has produced a new wine bottle stopper called Vino-Lok. The device is made of a glass bung surrounded by a plastic membrane and held in place by an aluminium cap. The manufacturer claims it is 100 per cent neutral, resealable, and recyclable.
What do you think are the advantages of using this stopper rather than cork or a screwtop?

Reading

Scanning

1 Look at the picture and the title of the text. What do you think the article is about?



Pedalling water

In many parts of the world farmlands are supplied with water through irrigation systems so that crops can be grown. Irrigation is necessary in parts of the world where rainfall is low or where rainfall is restricted to certain months in the year.

The treadle pump is an effective and environmentally-friendly technology used in many areas of Africa and Asia to lift water from shallow aquifers or canals. It costs about a quarter of the price of a motorized pump – from as little as US$12 to about $35 – and costs less to operate. The operator uses his / her body weight and leg muscles in a walking movement to pump the water. The pump can lift water from a depth of up to seven metres and produce between 3,500 and 5,000 litres of water per hour. It does not require a great deal of effort, so can be operated by anyone in the family, from children to grandparents. It is ideally suited to areas where the water table is at a high level. The treadle pump can provide water for up to 0.5 hectares of land and is very suitable for most small farmers who cultivate less than this.

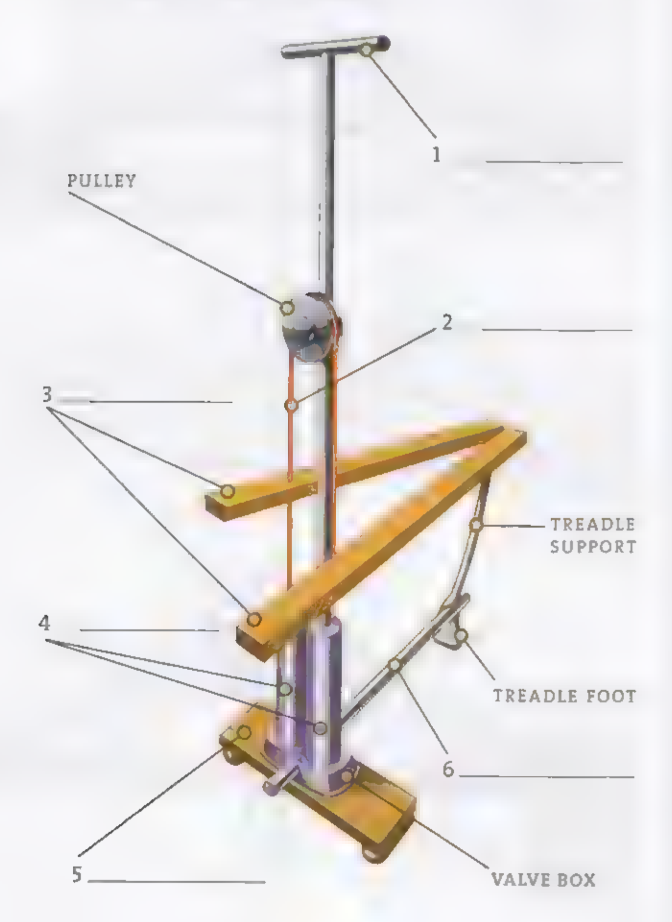
The pump consists of two pistons positioned inside two cylinders. Two treadles are connected to the pistons by a piece of rope. By treading on the two treadles in a walking motion, the pistons rise and fall, creating a vacuum that allows water to be pumped. The user has a handle to grip and the whole pump stands on a wooden baseboard. Water is drawn through a hose, pressurized, and then discharged in a steady flow through the discharge pipe to the field.

For many farmers these low-cost irrigation pumps have removed their reliance on a single crop, allowing them to grow more crops out of season. They can obtain higher yields and grow higher-value crops such as fruits and vegetables. This technology is helping the poorest in the world escape poverty and become more entrepreneurial.

2 Before you read, look at the table. Then, quickly scan the text to find the information to complete the table. Don't read the whole text, just try to focus on the information you need.

Treadle pump	
Cost	
Energy source	
Lifts water from a depth of	
Quantity of water produced	
Area of land can be irrigated	
Qualifications required to operate	

3 Now do the same to locate the information in the text you need to label the diagram.



Checklist

Assess your progress in this unit.

Tick (✓) the statements which are true.

- I can talk about the impact of agricultural inventions and developments
- I know how to use the Past Simple, Present Perfect Simple and Continuous
- I know how to begin a presentation
- I can scan a text for required information
- My reading and listening are good enough to understand most of each text in this unit

Key words

Nouns
barbed wire
canning
crop
dehydration
fermentation
grain
harvesting
irrigation
pasteurization
preservation
refrigeration
seed
yield

Verbs
germinate
pressurize

Note here anything about how English is used in technology that is new to you.

3 Bridges and tunnels

Switch on

1 Look at the bridges A–F. Do you know where they are? Can you name them?

2 What other famous bridges do you know?

Reading

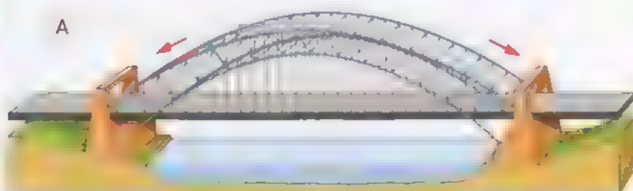
Bridge types

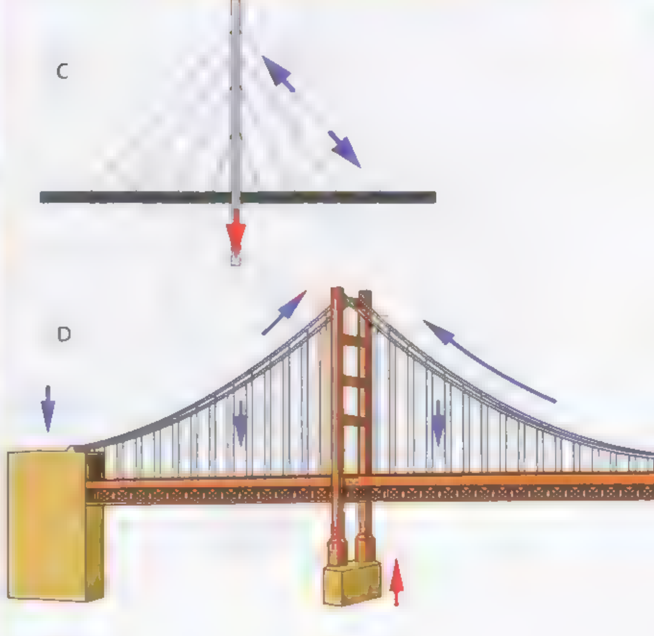
1 Study the diagrams of bridges A–D. Can you match them to the bridge types 1–4?

1 truss	3 suspension
2 arch	4 cable stay

2 Read this description and try to match it to one of the four bridge types in **1**.

Beam bridges are the simplest type. They have developed from a simple log across a stream to the large box girder bridges in use today. There are many different types. The one shown is a ____________ bridge The ____________ resists tension, compression, and shear. The forces on the supports of these bridges act directly downwards.





In this unit

- key terms in civil engineering – in particular bridge construction
- the Passive
- linking information from texts (written and spoken) and graphics
- evaluating the best solution to a situation

3 Work in groups. Read the text your teacher selects. Try to match each description to one of the bridge types in **1**.

1

__________ bridges have been in use for thousands of years. Originally built in stone and later brick, they are now built in reinforced concrete or steel. The newer materials allow much longer, lower spans to be built. __________ bridges carry their load by transferring it to the supports at either end.

2

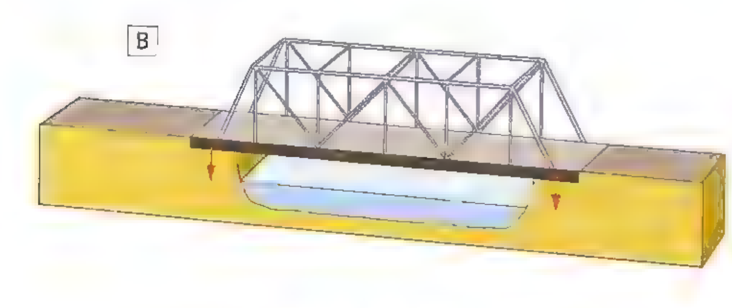
Box girder bridges cannot have a span of more than 500 metres because the spans would bend under their own weight. __________ bridges allow longer spans – up to 1,000 metres. The box girder deck is supported by super-strong cables tied to tall piers.

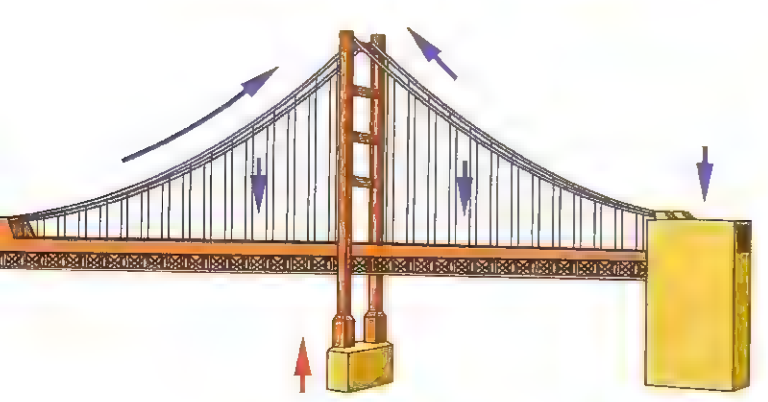
3

__________ bridges have a deck supported from overhead cables. These cables, supported by twin towers, require strong anchor points at each end to resist the inward tension of the cables. The deck is strengthened to control distortion by moving loads or high winds. Such bridges are light, and therefore the most suitable for very long spans.

4 Exchange information with the others in your group so that each diagram in **1** is labelled.

B





Language spot

The Passive

- Look at the diagram and the stages 1–4 for making the towers of a suspension bridge in a river bed.

1 *A reinforced concrete cofferdam* ***is placed*** *in the river bed.*
2 *The water* ***is pumped*** *out.*
3 *The tower* ***is constructed***.
4 *The cofferdam* ***is filled*** *with concrete.*



We often describe processes using the Present Passive.

- Sentences 1–4 are in the Present Simple. We make other tenses in the same way using the appropriate form of *be* and the past participle of the verb. For example:
The Golden Gate bridge ***was opened*** *in 1937.*
Truss bridges ***have been used*** *for centuries.*

- Modal verbs *must*, *can*, etc. are followed by *be* and the past participle. For example:
Bridges ***must be designed*** *to withstand the highest wind speeds recorded in the area.*

- We often use the Passive for safety signs in the work place. These include prohibition signs (things you must not do) and mandatory signs (things you must do).

For example:
High-visibility clothing ***must be worn*** *on the runway.*

- We often do not mention the agent (the person or thing responsible for an action) as the action is more important, or the agent unknown.

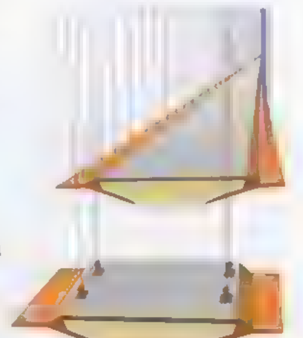
If the agent is important, we can add the information like this:
The tower is constructed ***by engineers***.

» Go to **Grammar reference** p.115

High Speed 1 links London to the Channel tunnel. The first part of the project consists of two parallel tunnels from St Pancras station to the River Thames. These 'twin bore' tunnels pass under 2,600 properties, 7 miles of surface railway, 12 existing tunnels – including 4 London Underground stations – and 600 gas, water, and sewage pipelines

1 Describe each of these processes for making the deck of a bridge using the Passive.

1 They make each deck section from steel.
2 Barges float the sections into position below the bridge.
3 Cranes hoist the sections.
4 They hang each section from the cables.
5 They weld each section into place.



2 Complete this short history of bridges using the correct form of the verbs in brackets.

The first bridges that ___________ 1 (build) were simple beam bridges: a tree used to cross a stream. Timber bridges ___________ 2 (use) ever since. Stone bridges ___________ 3 (build) by the Romans based on a simple arch. The new railways of the 19th century meant that longer bridges ___________ 4 (need) to cross wide valleys. Different materials ___________ 5 (use) in their construction. Viaducts of brick or stone ___________ 6 (construct) in Europe. Timber ___________ 7 (use) in parts of the USA. The expansion of roads in the 20th century ___________ 8 (lead) to the use of concrete bridges.

3 Convert each of these signs into a written warning using the Passive.

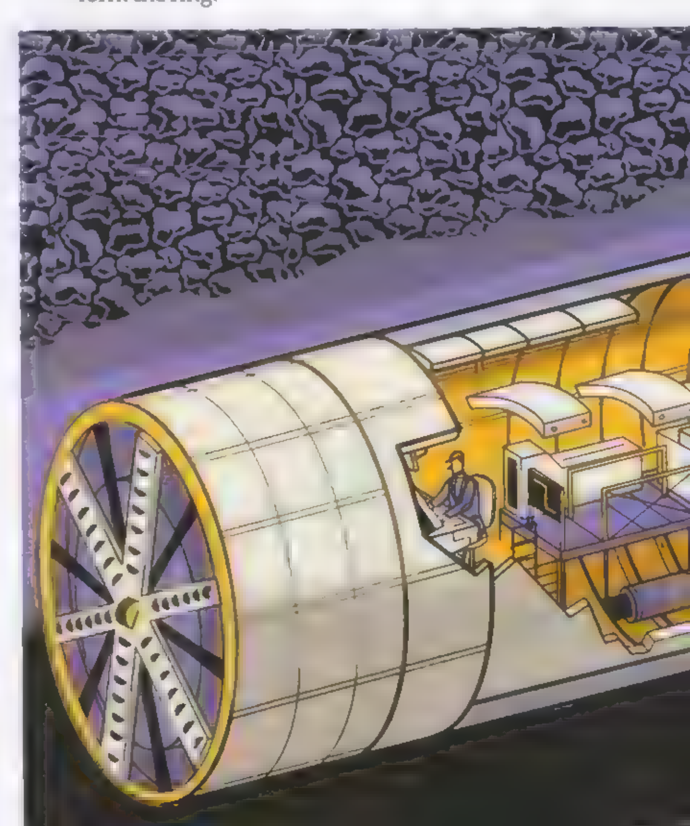
EXAMPLE
Check fire alarms weekly.
Fire alarms must be checked weekly.

1 Do not use mobile phones!
2 Wear eye protection.
3 Do not remove this extinguisher!
4 Switch off this machine before servicing
5 Clean up spillages.
6 Do not unload vehicles here!

4 Work in pairs. Study the diagram of a tunnel-boring machine (TBM) and try to explain how it works.

5 Convert these sentences to the Passive to make a description of tunnel construction. Include the agent each time a new agent is mentioned.

1 Construction Engineers use a number of methods to make tunnels.
2 They employ a simple cut-and-cover method for shallow tunnels.
3 They use explosives for tunnels in very hard rock.
4 They use a tunnel-boring machine (TBM) to make deep tunnels in soft rock.
5 The TBM protects workers and machinery.
6 A rotating cutterhead at the front cuts the rock.
7 Machinery at the rear removes the refuse.
8 Hydraulic jacks push the TBM forward.
9 The segment erector builds a new tunnel ring every 1.5–2 metres.
10 It places concrete segments in the right position to form the ring.



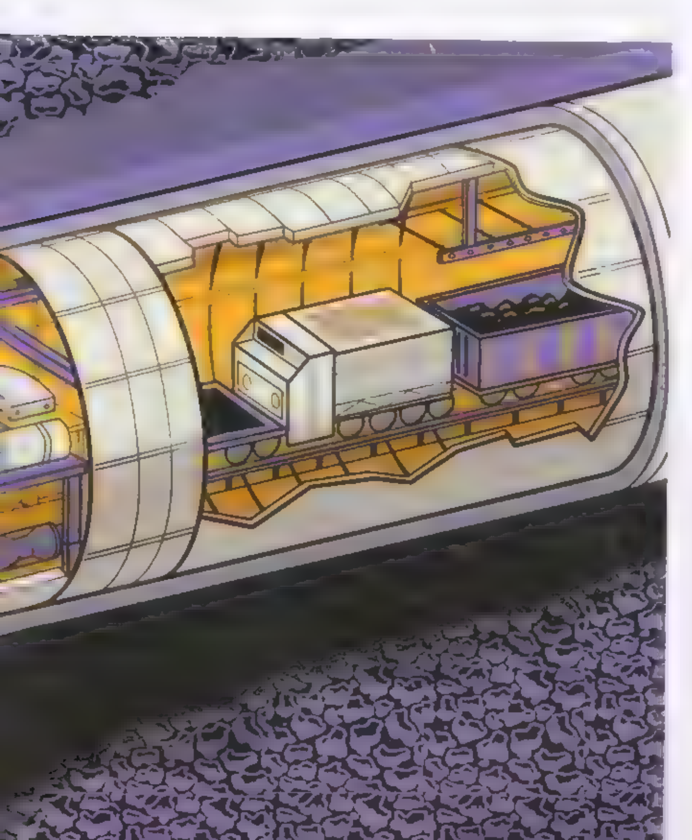
It's my job

1 Discuss the questions with a partner. Read the text about Sandra Lighter, a Tunnel Engineer, to check your answers.

1. What problems are there in cutting tunnels under a large city like London?
2. How accurate do you think tunnel-boring machines can be?

2 Read about Sandra again and answer the questions.

1. What does this tunnel make possible?
2. How is it possible for the tunnel-boring machines to work so accurately?
3. What was the solution to the problem of wet ground?
4. Why were there more problems nearer the centre of the city?
5. What damage did the tunnel suffer?
6. Why does she say, 'This is the reason I became an Engineer'?



Sandra Lighter: Tunnel Engineer

I'm a Tunnel Engineer. I'm 31. I've got a degree in Engineering from Manchester University. I've been working on the Channel Tunnel Rail Link for the last three years. It's a high-speed rail route linking the centre of London to the Channel Tunnel.

There aren't many women in my position, in charge of large gangs of men, but I don't have any problems. I'd like to see more women Engineers.

Two long sections of the line through London are in tunnels – a total of 17.4 kilometres.

We used six huge laser-guided tunnel-boring machines. They cut 100 metres a day with astonishing accuracy – a tolerance of just 25 millimetres. They had names, like ships – Annie, Bertha, Judy, and so on.

It was a real engineering challenge. In some areas near the Thames the ground is so wet that the tunnel is almost floating. There were pumps running 24 hours a day to drain the water away. Nearer the centre we had to avoid tube tunnels and sewers, and dig under buildings without weakening their foundations.

There are always dangers in tunnel construction, but we had only two serious incidents – a truck fire that destroyed much of the concrete lining in one area and a collapse where several gardens in east London disappeared into the tunnel.

It's been a fantastic project. It makes it [illegible] Paris in two and a quarter hours. It w[illegible] least 100 years, probably much longer [illegible] reason I became an Engineer.

The longest suspension bridge, the Akashi Kaikyo Bridge, has a central span of 1,991 metres.
The deepest road tunnel, 265 metres below sea-level, is in Norway.
The longest tunnel, the New York City–West Delaware water-supply tunnel, is 169 kilometres long.

Problem-solving

1 Work in groups of four. Study these pictures of bridges. These bridges share a common feature. What is it?

A

Bilbao cable-stayed Bridge, Spain (proposal)

B

Cape Cod Canal Railway Bridge, USA

C
Tower Bridge, London

D

Gateshead Millennium Bridge, Newcastle, UK

2 Match each of these verbs to one of the bridges.

verb	bridge
lift	
pivot	
tilt	
swing	

Take one bridge each and explain simply to the others in your group how it operates. Use the correct verb from the table.

3 Together decide which of the bridge types you have studied in the unit would be best for these crossings.

1 to take road traffic across a busy shipping route – the span is 120 metres
2 to link a number of islands in a shallow sea – shipping must be allowed to pass
3 to carry a railway across a valley – the width is 1,500 metres

Compare your group's solution with those of other groups.

Webquest

Find out more about one of the bridges in *Problem-solving* with the help of the websites below or by using a search engine. Describe its main features to the rest of the class. Complete at least the following information for each bridge.

Type	
Function	
Location	
Designer	
Year completed	

Technical data and illustrations of thousands of structures including bridges
- www.structurae.de/en/structures

A gateway site to many Webpages on bridges
- http://42explore.com/bridge.htm

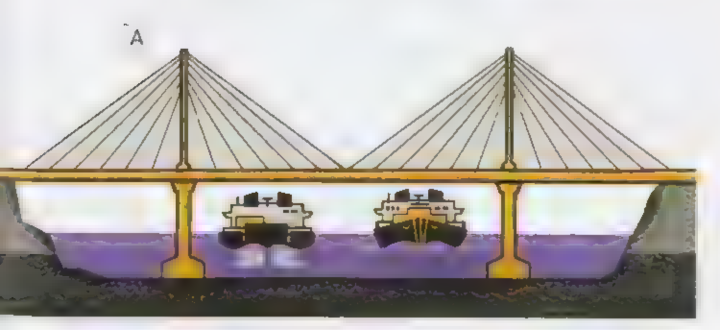
Non-specialist explanations
- www.travel.howstuffworks.com/bridge

An online encyclopaedia with a lot of technical information
- http://en.wikipedia.org/

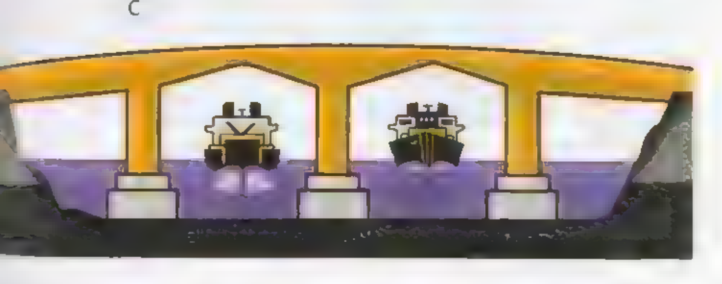
Listening

The Great Belt East Bridge

1 Study these three designs for the Great Belt East Bridge. Try to name the types of bridges.







2 Listen to the recording without stopping it. Try to put the designs in the correct sequence.

3 Listen to the recording again as often as you want. This time, listen for detail. Add to each diagram the year of the design and any measurements which are given.

Checklist

Assess your progress in this unit. Tick (✓) the statements which are true.

I know the key terms in bridge construction

I can use the Passive in technical descriptions

I can evaluate the best solution to a situation

My reading and listening are good enough to understand most of each text in this unit

Key words

Nouns
accuracy
cable
compression
distortion
lining
pier
project
reinforced concrete
sewer
shear
span
suspension bridge
tension
tolerance

Verbs
weaken

Note here anything about how English is used in technology that is **new** to you.

4 Plastics

Switch on



1 Look at the pictures of plastic products. Discuss why plastic has been chosen for each of these items.

EXAMPLE

Plastics are used for fuel tanks because they are ***resistant to chemicals****. Fuel tanks have to be strong and last a long time, and plastics are* ***durable****.*

2 Make a list of the properties of plastics that make them suitable materials for such a wide range of products.

Listening

The history and properties of plastics

1 What were the first plastics made from? What are plastics produced from today?

2 Listen to two Technology students talking about plastics. As you listen, complete the table of raw materials and the plastics made from them.

	Raw material	Plastic
1	cellulose	________
2	________ and ________	polyethelene, nylon, polyester
3	starch from plants (e.g. wheat)	________

3 Listen again and note the advantages and problems with each of the different types of plastic, as well as recycled plastic – 4.

	Advantages	Problems
1		
2		
3		
4		

In this unit

- listening to people discussing raw materials and plastics
- talking about ability and inability
- identifying plastics codes
- describing a pie chart
- disappearing sounds and word linking

Language spot

Ability and inability

- Study the ways the speakers talk about what is / is not possible:

*They **couldn't** make things to a high standard of quality.*
*Manufacturers **can** use plastics to produce almost anything nowadays.*
*We'**ll be able to** use other raw materials in the future.*
*In the mid-nineteen hundreds plastics production **was** really **able to** take off.*
*Plastics **could** be made from plants in the future.*

- We use *can/cannot* or *is/are (not) able to* for present time, *could/couldn't* or *was/were (not) able to* for past time, and *will (not) be able to* for future time or opportunities.

- To form sentences in the passive we use *be* + past participle of the verb.

*Things **couldn't be made** to a high standard of quality.*
*Plastics **can be used** to make almost anything nowadays.*

- For the future, we often use *It will/won't be possible to ...*, not *will/won't be able to*.

***It will be possible to** use other raw materials in the future.*

This is better than:

*Other raw materials **will be able to** be used in the future.*

» Go to **Grammar reference** p.115

1 Match A and B to make sentences.

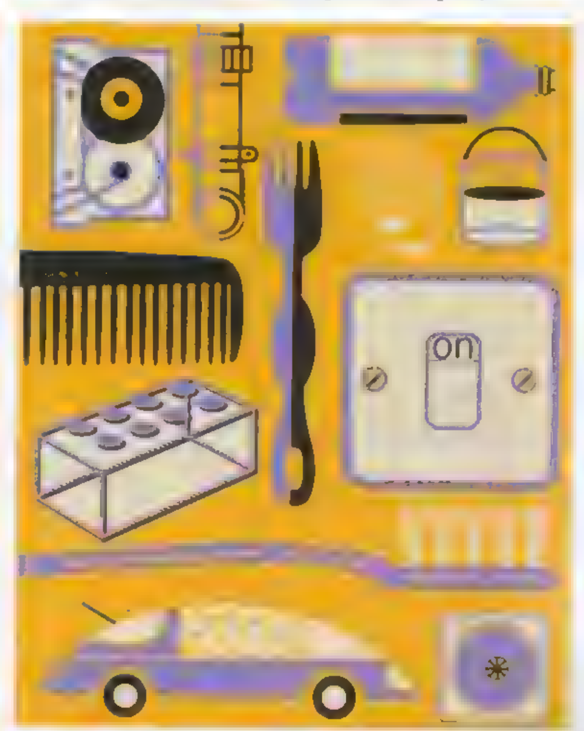
A	B
1 Scientists couldn't	a can be made very cheaply.
2 Manufacturers were able	b cannot be sold due to high costs.
3 Modern plastic products	c be recycled effectively with good plastic collection systems.
4 Bacteria can	d to develop a wide range of plastics from oil, coal, and gas.
5 Plastics can	e mould the first cellulose plastics.
6 More biodegradable plastics	f break down plant-based plastics.

2 Discuss manufacturers' ability to do these things in the past, present, or future. Use the notes in brackets to help you.

EXAMPLE

Mass-produce items from celluloid. (not possible in past)
Manufacturers couldn't / weren't able to mass-produce items from celluloid.

1 Mould modern plastics into complex shapes. (possible now)
2 Colour casein, which was made from milk. (possible in past)
3 Make cars completely from plastics. (not possible now / possible in future)
4 Use plastics to help designers reduce weight in aircraft. (possible now)
5 Replace metal components in engines with plastic. (possible now)
6 Recycle waste thermoplastics. (possible now)
7 Recycle waste thermoset plastics. (not possible now)
8 Produce nylon in 1900. (not possible in past)



Problem-solving

1 There are well over a thousand different plastics. Work in pairs and match up the codes with the names of these most widely-used plastics.

1	LDPE	a	unsaturated polyester
2	HDPE	b	polystyrene
3	PP	c	acrylonitrile butadiene styrene
4	PVC	d	polypropylene
5	PS	e	polyethylene (low density)
6	EPS	f	polyesters
7	PA	g	polyethylene (high density)
8	ABS	h	nylon
9	PET/PBT	i	polyvinylchloride
10	UP Resin	j	expanded polystyrene

2 Try to find the names and codes of other plastics. These sites may help:
- www.bpf.co.uk
- www.eng.morgan.edu

Webquest

1 Where would you find the following symbols?



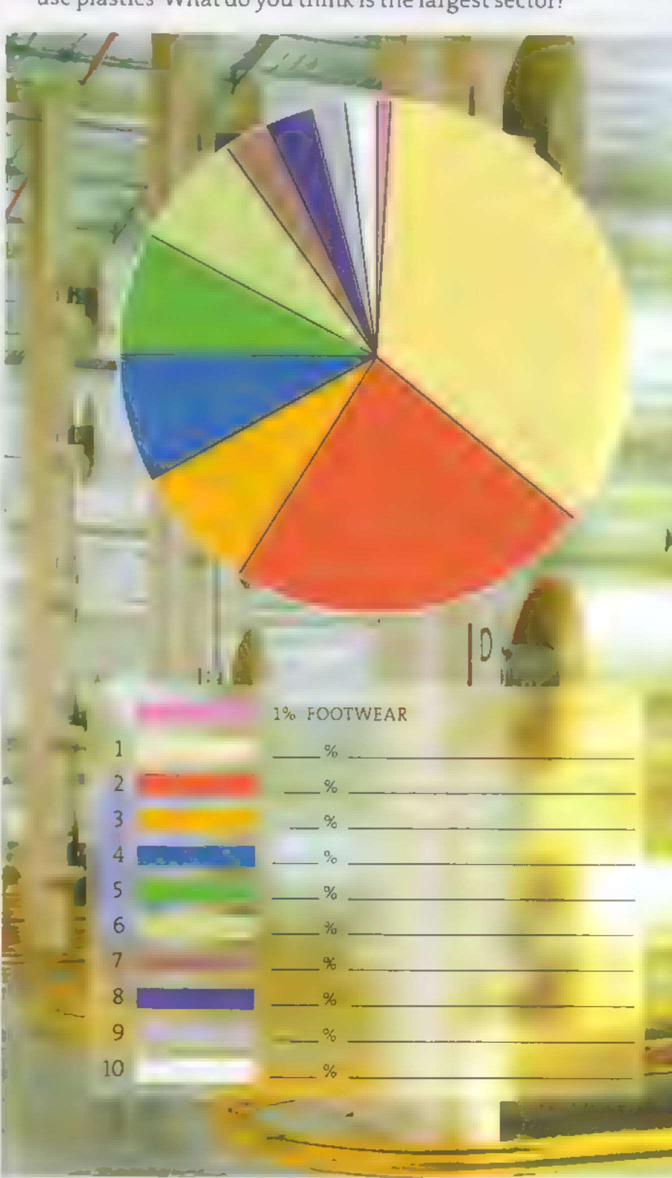
2 Find out about these symbols. What do they mean and what is their purpose?

These sites may help:
- www.pac-it.org
- http://en.wikipedia.org
- http://americanplasticscouncil.org

Make your point

Describing a pie chart

1 Look at the pie chart showing the different sectors which use plastics What do you think is the largest sector?



2 Listen to Lee Avatar giving a presentation describing the use of plastics and complete the chart. If necessary, listen again.

Gadget box

A maker of traditional musical instruments, Ted Brewer, has decided to use a special-effect resin to make his instruments more visually attractive. He can create a special light feature by using two super-bright white LEDs. By using a thermoset resin he can achieve high performance and design flexibility. Injection moulding allows the creation of unique designs which give excellent sound quality.

Can you play a musical instrument? Would a colourful instrument like this encourage you to start playing or practise more?



3 Read Lee's *Useful Language*. Listen to Lee's presentation again and tick the expressions you hear him use.



USEFUL LANGUAGE FOR REFERRING TO VISUAL AIDS

- I'd like to show you a pie chart which represents ... ☐
- This pie chart represents ... ☐
- If we take a look we can see ... ☐
- You will notice . . ☐
- I'd like to draw your attention to ... ☐
- As you can see, ... ☐
- Take a look at ... ☐
- You will see . . ☐
- You can see that ... ☐

4 Work in pairs. You have information for a pie chart below. First draw a pie chart to represent your information then prepare a short presentation and give it to your partner. Your partner should listen, take notes, and give you feedback on your presentation.

UK consumption of plastics by type

Plastic	Per cent
L/LLDPE	20
PP	16
PVC	16
HDPE	11
PET/PBT	6
PS	5
others	26

Pronunciation

Disappearing sounds and word linking

In fast speech we often don't pronounce a final *t* or *d* sound when it is followed by a consonant sound. When a final *w*, *y*, or *r* is followed by a vowel sound we link the two words and pronounce the letters.

1 Look at the bold letters in the sentences. Listen and tick (✓) the sentences where you hear the **bold** letters. Place a cross (✗) beside the sentences where you don't hear the **bold** letter.

1 **A** This is a thermoset plastic.
  B This is a thermoset application.

2 **A** It's used in household items.
  B It's used in household products.

3 **A** One process is blow moulding.
  B It's used to make hollow items.

4 **A** It meets safety standards.
  B They must use safety equipment.

5 **A** It's a softer material.
  B It's a softer option.

Listen again and check.

2 Look at the example below. Then cross out the letters in sentences a–e which you expect to disappear, and mark where you think sounds will be linked.

EXAMPLE

Powder is heated in a closed mould.

a Light stabilizers prevent light damage.

b Plasticizers are used to make plastics softer.

c Even the street lights are made of plastic.

d Plastics production was really able to take off.

e Polyester fibres are used a great deal in clothing.

3 Now listen and check your answers and then repeat the sentences.

The world's annual consumption of plastic materials has increased from around 5 million tonnes in the early 1950s to nearly 100 million tonnes today.

Vocabulary

Collocations in plastics

1 Some words are often used together. Fill the gaps in sentences 1–6 with a word from the list that often goes with the word in **bold**.

appliances   industry   moulding
components   materials   process

1 Oil and natural gas are the main **raw** ______________ used in the production of plastics.

2 Compression moulding is one example of a **production** ______________ .

3 Plastics are used in the production of a wide range of **household** ______________ .

4 Reinforced plastics are a major building material in the **construction** ______________ .

5 The car industry uses **high-precision** ______________ in their vehicles.

6 The majority of plastic parts are manufactured using **injection** ______________

2 Match a word in A with a word in B to fill the gaps in sentences 1–6.

A	B
medical	fibres
textile	containers
man-made	properties
food	life
chemical	devices
expected	polymer

1 A plastic is a type of synthetic or ______________ ______________ .

2 Polymers can be moulded into various shapes or drawn into filaments that can be used as ______________ ______________ .

3 Additives are added to improve the mechanical, physical, or ______________ ______________ .

4 Products which have an ______________ ______________ of more than three years are known as durables.

5 ______________ ______________ that are used to treat or monitor patients are non-durables and are not expected to last longer than three years.

6 PET is clear, tough, and a good barrier to gas and moisture, so supermarkets find it ideal for ______________ ______________ .

Reading

Packaging technology

1 In the supermarket, why is food wrapped in clear packaging?

Read the first paragraph of the text and check your answer.

2 Now read the rest of the text.



Green and intelligent

Food shopping is changing and so too is the way food is wrapped for sale. Clear plastic wrapping allows the consumer to see the state of the food inside at the same time as preventing contamination from dust and bacteria. But now supermarkets are looking at new types of packaging.

Some supermarkets have decided to wrap their fresh fruit and vegetables in biodegradable plastic packaging instead of conventional plastic. Biodegradable plastics or bioplastics can be made from plant-based materials such as starch from corn, wheat, or potatoes. In the environment, micro-organisms are able to break down these plastics easily and quickly to produce carbon dioxide and water. Biodegradable plastics can also be made by some bacteria that are capable of producing granules of plastic (PHA/PHB) in their cells. Biodegradable plastic packaging can be composted and allows customers to dispose of their own waste at home.

Active packaging is a new development that can interact with the product to improve it or provide the consumer with information about the freshness of the product. An American company has developed a label that indicates the temperature a package has been stored at. A chemical in the label polymerizes and becomes darker in colour if the temperature rises.

Another company has developed a membrane wrapper which changes its permeability to oxygen and carbon dioxide as the temperature changes so that the best O_2 / CO_2 balance can be achieved inside the packaging.

3 Complete the table with the different packaging technologies mentioned and their advantages.

Packaging technology	Advantages

4 What effect do you think these new technologies will have on the environment? / the plastics industry? / the consumer?

Checklist

Assess your progress in this unit. Tick (✓) the statements which are true.

- I can talk about ability and inability to do things
- I know codes for plastics
- I can describe a pie chart
- I know when to pronounce the final sound in a word
- My reading and listening are good enough to understand most of each text in this unit

Key words

Adjectives
biodegradable
durable
thermoset
versatile

Nouns
bacteria
cellulose
component
consumer
packaging
pigment
plasticizer
raw materials
thermoplastic
wrapping

Verb
dispose of

Note here anything about how English is used in technology that is **new** to you.

5 Alternative energy

Switch on

Identify these sources of alternative energy. Work in groups and discuss how each can be used to replace fossil fuels like oil, gas, and coal.



Listening

Wave Energy Innovator



1 You are going to hear a radio programme about wave energy. Before you listen, work in groups and discuss the questions.

1. Look at the picture, what do you think this is?
2. What problems are there in using wave energy?
3. What is a wave farm?
4. What are carbon emissions?
5. What does it mean if a project is *commercially viable*?

2 🎧 Now listen to the programme and answer the questions.

1. What does Richard's company make?
2. How much power will the wave farm produce when complete?
3. Where did Richard study?
4. What names have people given to previous wave converters?
5. Why did Richard call it Pelamis?
6. How did Richard find the name?

3 🎧 Listen again and note the answers to the questions.

1. How does he describe Stephen Salter?
2. What expression does Richard use which means 'talking endlessly about something'?
3. What expression does Richard use which means 'follow up your words with action'?
4. What does Richard feel about 'making clever things'?
5. His company has two objectives. One is to earn revenue for people. What is the other?

In this unit

- key terms in alternative energy
- Past Continuous v Past Simple
- making inferences from written text
- strategies for remembering technical words

Language spot

Past Continuous v Past Simple

- Study this example:

*I **discovered** wave energy when I **was doing** my PhD at Edinburgh University.*

- We use the Past Continuous for an action in progress in the past when something else happened, or to describe the background to an account or report.

- We use the Past Simple for a complete action in the past.

- These tenses are often used together when one action comes in the middle of another longer action. Sometimes this is signalled by time words such as *while*, *when*, or *as* before the longer action.



I discovered wave energy.
PAST PRESENT
I was doing my PhD at Edinburgh University.

- We use the Past Simple for a series of past actions.

*We **did** a quick Google search on sea snakes and **found** Pelamis.*

- We normally use the Past Simple, not the Past Continuous, to describe states and actions which take very little time.

*And we **liked** that.*
*I **saw** that people were doing something really important.*
*The accident **happened** suddenly.*

>> Go to **Grammar reference** p.116.

1 Match phrases 1–6 with phrases a–f to make sentences. Put one verb in the Past Continuous and the other in the Past Simple.

1 When they (dig) under London,	a while most people (sleep).
2 Rutherford (work) in Manchester	b he (meet) Professor Salter.
3 The earthquake (happen) late at night,	c they (have) to alter the design.
4 As it (come in) to land,	d part of the tunnel (collapse).
5 When Richard (study),	e the aircraft (crash).
6 When they (construct) the bridge,	f when he (split) the atom.

2 Put the verb in brackets in the appropriate tense – Past Continuous or Past Simple.

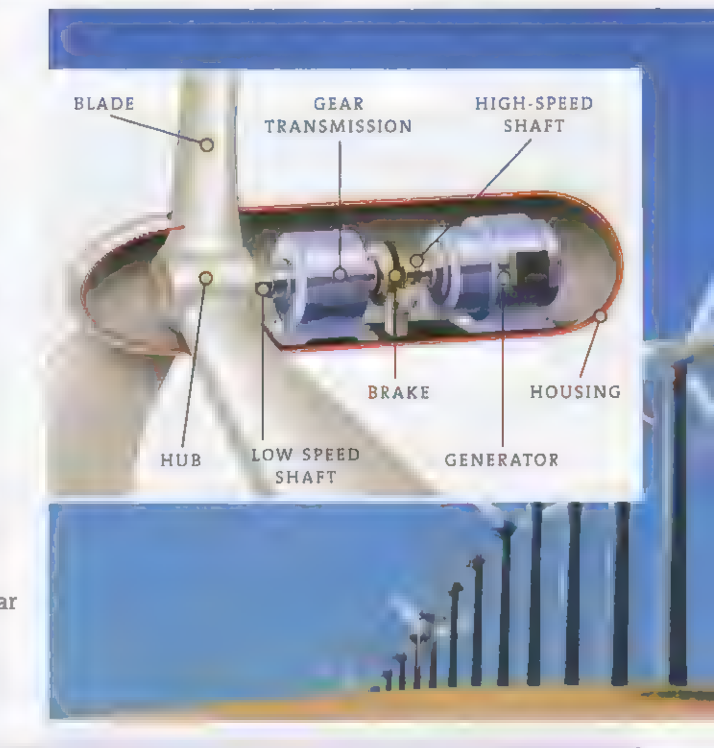
1 We __________ (do) a Google search and __________ (find) the answer very quickly.
2 When he __________ (work) in Nigeria, there __________ (be) a serious accident on the oil rig.
3 When Trevor Baylis __________ (hear) about communication problems in Africa, he __________ (decide) to build a radio without batteries.
4 While the operation __________ (go on) in France, doctors in other countries __________ (be able to) assist using telesurgery.
5 The police __________ (use) a Taser gun because they __________ (think) the suspect might hurt someone.
6 He __________ (not wear) a hard hat when the accident __________ (happen), so he hurt his head.
7 The motor __________ (run) when he __________ (remove) the guards. It was a stupid thing to do.
8 The accident __________ (be) his own fault. He __________ (use) a grinder without wearing eye protection when it __________ (happen).
9 While the generator __________ (run), a fault __________ (develop) in the main bearing.
10 As they __________ (build) the wind farm, protestors __________ (damage) some equipment.

Reading

Making inferences

1 Match components 1–8 with their functions a–h with the help of this simplified diagram of a wind turbine.

A		B	
1	hub	a	transfers power to the generator
2	blades	b	links the blades to the low-speed shaft
3	gear transmission	c	contains the main components
4	high-speed shaft	d	stops the turbine
5	generator	e	capture the wind energy
6	housing (nacelle)	f	increases the speed of the shaft
7	brake	g	relays power to the gear transmission
8	low-speed shaft	h	produces electricity



2 Now read the text and check your answers to **1**.

Wind power

Wind power is renewable and non-polluting and can be used to drive wind turbines like the one illustrated. Wind farms consisting of numbers of turbines are increasingly being constructed both on land, usually on high ground, and offshore.

Wind speeds increase with height, so turbines are mounted on towers, typically 50 to 80 metres in height. Most towers are tubular to allow safe access for maintenance.

The rotor blades capture the wind and transfer its power to the rotor hub, which is attached to the low-speed shaft of the turbine. Each rotor blade measures about 27 metres in length and is designed much like an aeroplane wing. The rotor rotates quite slowly, at about 30 r.p.m.

The nacelle, the casing at the top of the tower, contains the most important components including the gearbox, generator, and computer. The low-speed shaft transmits power from the hub to the gearbox. It contains pipes for the hydraulic system, which operates the aerodynamic brakes. The gearbox increases the speed of the rotor shaft by about 50 times. The high speed shaft drives the electrical generator. It has a mechanical disc brake for emergency use.

The generator produces electricity by electromagnetic induction. On a large turbine, the power generated is between 600 kW and 3,000 kW. The power is sent by cable to the national grid.

The anemometer and wind vane on top of the nacelle measure the speed and direction of the wind respectively and send this information to the computer. The computer activates the yaw motor, which turns the rotor into the wind. It starts the turbine when the wind reaches about five metres per second. The computer continuously monitors the conditions of the turbine. It controls the speed of the rotor by varying the pitch of the blades. If the wind reaches storm force, about 25 metres per second, the computer closes down the turbine to prevent damage.

Gadget box

Photovoltaic roof tiles not only keep the rain out, but generate 50 watts of electricity for every 0.5m² of tiles. What area would you need to power an average home?





3 Put the sentences in the correct order to describe the operation of the turbine.

a The computer uses the yaw drive to turn the turbine into the most effective position. ______

b The gearbox increases the speed of the rotor shaft by 50 times. ______

c The high-speed shaft drives the electric generator. ______

d The wind strikes the blades which turn the low-speed shaft. ______

e The power is sent by cable to the national grid. ______

f The generator converts the mechanical energy into electrical power. ______

g The anemometer and wind vane determine the wind speed and direction and transmit this to the computer. ______

h The computer starts the turbine when wind speed reaches 5 m/s. ______

Making inferences

Sometimes the information we want when we read is not stated clearly in the text. We have to infer it. That means we have to work it out by linking different pieces of information in the text or by combining text information with our knowledge of the text topic. For example:

Question What are the best places on land to build a wind farm and for what reasons?

- Information from the text:

1 *usually on high ground*

2 *wind speeds increase with height*

- From our knowledge of the text topic:

3 *preferably near existing transmission lines to save costs*

Possible answer *On high ground, because wind speeds are greatest, and preferably near existing transmission lines to save costs.*

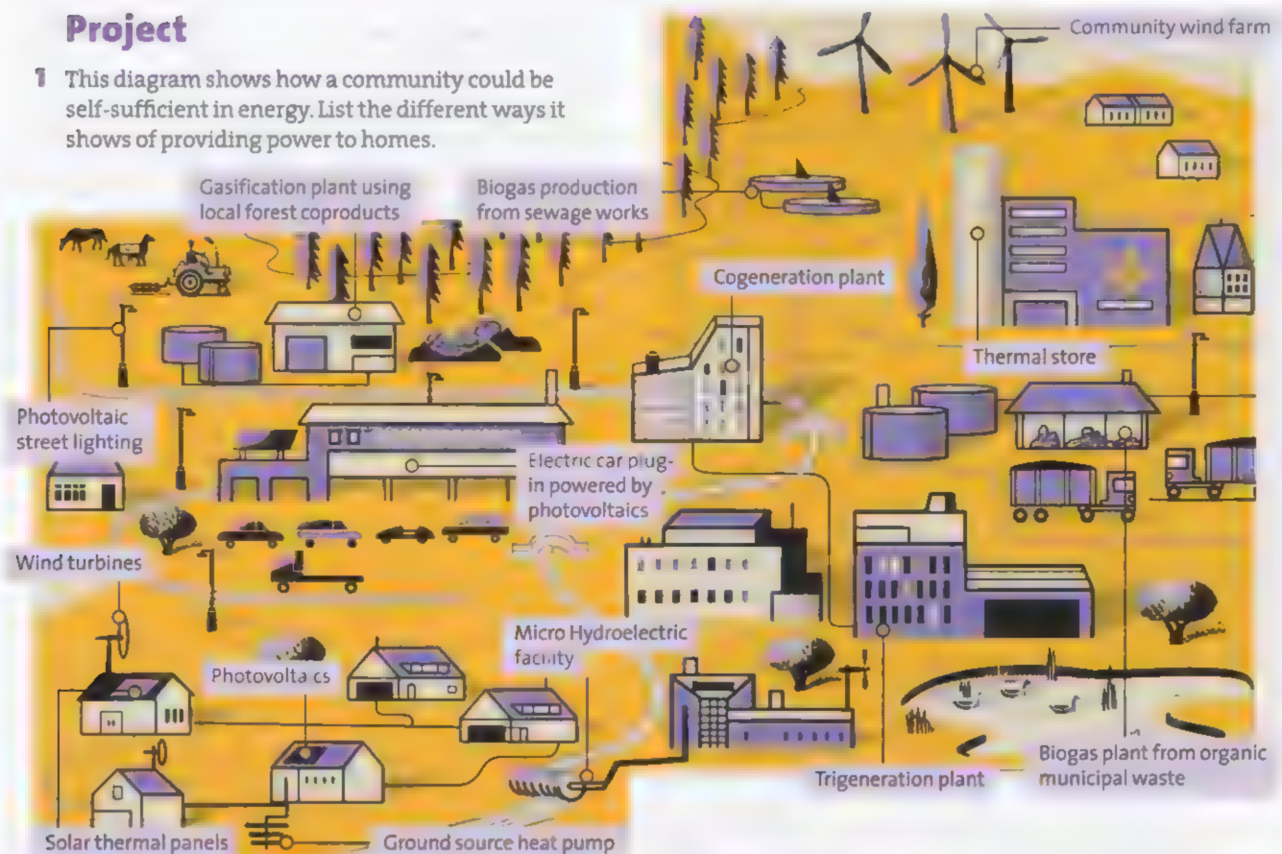
4 Use information from the text and your own knowledge to answer the questions

1 Why are some wind farms constructed offshore?
2 Why are wind turbines grouped together in wind farms?
3 Why do tubular towers provide safer access than some other kinds of tower?
4 What is the approximate diameter of the wind turbine rotor in the picture?
5 At what speed does the high-speed shaft rotate?
6 Why is a gearbox necessary?
7 What is the maximum output from this type of generator?
8 What is the difference between the anemometer and the wind vane?
9 Why does the yaw mechanism turn the turbine into the wind?
10 What is storm force in km/h?

Nuclear energy may just be the energy source that can save our planet from catastrophic climate change
Patrick Moore, *co-founder of Greenpeace*

Project

1 This diagram shows how a community could be self-sufficient in energy. List the different ways it shows of providing power to homes.



2 What do you think these features shown on the diagram are? Check your answers with a good technical dictionary or use Google. (Tip: enter ***define***: followed by the unknown term.)

1 a cogeneration plant
2 a trigeneration plant
3 a gasification plant
4 a thermal store

3 Find the answers to the questions

1 How is street lighting powered?
2 What is organic waste used for?
3 Why is it an advantage to be near woods, hills, and a river?
4 What kind of private transport is used?

4 With a partner list the forms of energy shown in the diagram which could be used to make your own community more self-sufficient in energy. Give reasons for those you choose and those you reject.

Webquest

Work in groups. Research one of these topics and report your findings to the rest of the class.

1 Avedøre-2 multi-fuel power plant, Denmark
2 Trigeneration
3 Combined Heat and Power (Cogen) use in Rotterdam
4 Renewable energy projects in Malmo, Sweden
5 Thermal stores

These sites may help:

www.cogeneration.net/TrigenerationExplanation.htm
www.power-technology.com/projects/avedore/
www.enecho.meti.go.jp/english/energy/

UK Department of Trade and Industry:
www.dti.gov.uk/renewable/

Danish Wind Industry Association:
www.windpower.org/en/

Vocabulary

Grouping words

One way to remember your growing technical vocabulary is to group words into sets, for example words which describe shapes, treatments, or properties of materials.

1 These verbs all describe movement in mechanisms. Use each verb once to complete sentences 1–8, which describe the mechanism in the picture.

drive	rotate	stop	transmit
increase/decrease	start	transfer	turn



1 The pedals ______________ power to the chain wheel.
2 The chain ______________ power to the rear wheel.
3 The gears ______________ or ______________ the speed of rotation of the rear wheel.
4 Each time the chain wheel turns, the rear wheel ______________ three times.
5 At 30 km/h., the chain wheel ______________ at 238 r.p.m.
6 To ______________ the bicycle, use the brakes.
7 When you ______________ to pedal, you have to overcome static friction.
8 The front wheel ______________ the dynamo.

Another way is to remember word partners, words which go together like *fossil* + *fuel*.

2 Each of these words is used with *energy*. Separate them into words which go before and words which come after *energy*.

change	conversion	mechanical	solar
chemical	electrical	nuclear	
conservation	heat	potential	

Checklist

Assess your progress in this unit. Tick (✓) the statements which are true.

- I know the English words for alternative energy sources
- I know the important differences between the Past Continuous and the Past Simple
- I can make inferences when I read
- I know ways of remembering technical words
- My reading and listening are good enough to understand most of each text in this unit

Key words

Adjective
commercially viable

Adverb
offshore

Nouns
carbon emissions
converter
fossil fuel
gearbox
hydraulic system
renewable energy
turbine
wave
wind

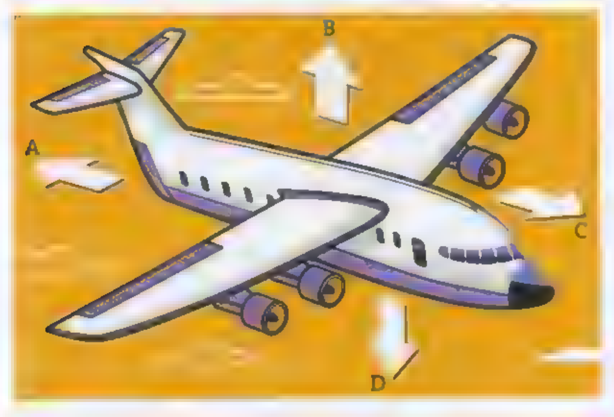
Verbs
activate
collapse
convert
transmit

Note here anything about how English is used in technology that is **new** to you.

6 Aeronautics

Switch on

1 Label the diagram with the four forces – *lift, drag, thrust*, and *weight*.



2 Look at the pictures that show the different movements of a plane and label them *yawing, pitching*, and *rolling*

A

B

C

3 Match the parts of the plane 1–7 with their functions a–g.

1 wings
2 engines
3 landing gear
4 flaps
5 spoilers
6 stabilizers
7 cockpit

a used to slow the plane or help it descend
b provide stability, keeping the plane level
c houses all the instrument panels and the pilots
d provide lift and usually store fuel
e supports the plane on the ground
f provide greater wing area, giving more control for landing and takeoff
g provide thrust

Now label the parts of the plane which control *yawing, pitching*, and *rolling*

1
2
3
4
5
6
7

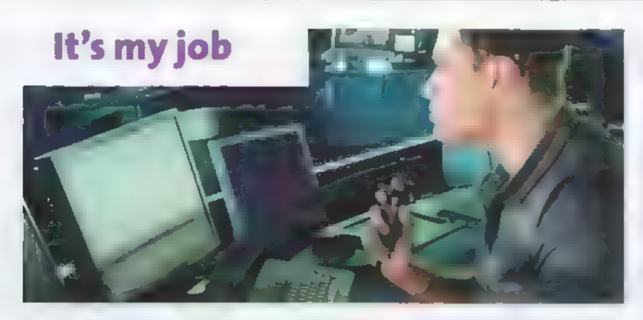
AIRPORT

[redacted]

In this unit

- key terms about flight
- reading about air traffic control
- First and Second Conditionals
- checking information on the phone

It's my job



1 What does an Air Traffic Controller do? What skills does a person need to do this job?

2 Read about Alan Bueno, an Air Traffic Controller. List the different jobs Alan mentions and note what responsibilities each job involves. List the tasks which are common to all jobs.

EXAMPLE

Job	**Responsibilities**
Aerodrome Controller	*looks after planes arriving and departing*

3 Read the text again and answer the questions.

1. What equipment does Alan use in his job?
2. What sort of information does the Controller have to pass on to Pilots?
3. How can an Air Traffic Controller help a Pilot who is lost?
4. How did Alan train to become an Air Traffic Controller?

4 Find words in the text with similar meanings to 1–6.

EXAMPLE
continue speaking on the radio
maintain radio contact

1. moving on the ground at the airport ______________
2. the places where aircraft park at the airport ______________
3. follow the movement of aircraft in the air ______________
4. the height a plane flies at ______________
5. comes towards the airport ______________
6. radio messages asking for help ______________

Alan Bueno: Air Traffic Controller

There are actually several different jobs that Air Traffic Controllers do. Interestingly, only 20% work in a tower at an airport. They are Aerodrome Controllers. They work in the visual control tower, but at busy airports, the job will actually be split between Air Controllers, who have to guide aircraft during landing, and Ground Controllers, who manage aircraft on the runway. They instruct the Pilot about taxiing to and from parking stands and holding areas.

Then there are Area Controllers. I'm an Area Controller and I have to handle aircraft in flight. I could be in communication with several aircraft at the same time. I work at a control centre, away from the airport itself, where I track the exact position of aircraft from my work station using radar and computer systems as well as radio equipment. I'm in constant radio contact with Pilots, updating them with information about the weather, special conditions, and any relevant information. It's my job to manage the airspace and issue instructions about which route a plane should take, the speed and the altitude they should hold.

Approach Controllers take over from Area Controllers as the plane approaches the airport. They make the decision about where and when a plane lands and also decide on the order in which planes land.

In addition, Air Traffic Controllers have to respond to distress calls. If a plane becomes lost or its equipment fails, we can give the Pilot details of his/her position and guide them to safety.

To be an Air Traffic Controller, you have to be able to work calmly under pressure and take decisions quickly. You have to be able to interpret data from different sources and be confident with technology. You also need good spatial vision and a good memory.

When I was nineteen, I applied to Air Traffic Control college. After a tough selection process, I spent twelve months at college. Then I was a trainee at a control centre for two years working under the supervision of an experienced instructor. Once I get a bit more experience, I could earn as much as €80,000 a year!

Problem-solving

1 Look at the design for the SAX-40 plane. How is it different from conventional aircraft design such as the A380? Make notes.

2 Complete the table to compare a conventional aircraft with the SAX-40. Choose from the boxes on p.37.

	Conventional aircraft	SAX-40	Result
1	irregular surfaces cause noise	blended wing design	
2	lift is created by the wing shape		
3	engines below the wing create most noise at take-off		
4	no sound-absorbing materials in the engines		noise is absorbed
5	engines suspended below the wings cause drag and noise		
6	high-speed engine exhausts create noise		
7	air around the landing gear creates noise	fairings cover the wheels and braking systems	
8	air flowing from the top surface of the wing off the trailing edge produces noise		reduce trailing edge wing noise



Gadget box

The Moller Volantor can operate up to three metres above any surface: land, water, sand, snow, swamp, and grasslands. It is a vertical-take-off-and-landing vehicle (VTOL). It has a maximum speed of 160 kph. The vehicle uses state-of-the-art fly-by-wire computer technology to monitor, control, and maintain stability of the vehicle. This technology means that it is simple and easy to operate.

List the advantages that the *Volantor* has over a car, helicopter, or plane.

SAX-40

A long engine exhaust ducts provide space for acoustic liners	B trailing edge brushes can be found at the back of the wing	C aerofoil shape means the whole body creates lift
D engines embedded in the frame	E engine intakes above the wing	F variable exhaust nozzles on the engines can be closed for take-off and landing

RESULTS

U upper surface shields people on the ground from the noise	V reduce noise when closed but maximize fuel efficiency when open at cruising altitude	W plane can make a slower approach and so reduce noise
X create smooth airflow below the aircraft and so less noise	Y smooth airframe reduces turbulent airflow and noise	Z reduce drag and noise

Language spot

First and Second Conditionals

- First conditional and time clauses

Ed *I think this design is great, but will it ever fly?*

Mari *Well, if the tests run satisfactorily, it could be in the air by 2030.*

Ed *But what'll happen if the project runs out of money?*

Mari *As soon as people realize the environmental advantages of a plane like this, they'll be happy to finance it.*

Ed *I certainly think that if we want to reduce noise, we'll have to come up with some radical designs.*

Mari *Yes, but unless there is also an increase in fuel efficiency, the investment won't be there. The researchers say that it'll be more fuel-efficient if they remove some of the noise-reducing features.*

- We use the First Conditional to talk about a possible scenario or action and the probable result. We usually form the result clause with *will*, but it is also possible to use *could*. The time or conditional clause is in the Present Simple.

1 Underline the time or conditional clauses above. Circle the conjunction of time or condition.

2 Complete the following sentences with the correct form of the verb in brackets.

1 We won't have the necessary skills to deliver R&D if we ______________ (not encourage) more students to study Aerospace technology.
2 Unless we have more skilled Software Engineers, we ______________ (have) problems developing new programs.
3 I think there will be many changes to the design before it ______________ (be) manufactured.
4 When you ______________ (finish) your training, you'll work as a trainee at the airport.
5 If Designers use a blended wing design, there ______________ (be) less turbulent airflow.
6 Unless the aircraft ______________ (make) a slower approach, there will be too much noise.

- Second Conditional

*If everyone **had** their own flying machine, the airspace **would be** very crowded.*

*The project **wouldn't be** possible if we **didn't have** the support of the airlines.*

*If Concorde still **flew** to America, people **would get** there in four hours.*

- We use the Second Conditional to talk about an imaginary scenario and to speculate on the result. The conditional clause is in the Past Simple tense and we express the result with *would* + infinitive verb form.

3 Complete the sentences with your own ideas.

1 If engineers succeeded in creating a silent aircraft, ______________
2 Aircraft would be more environmentally-friendly if ______________
3 If Design Engineers didn't have such advanced computer tools, ______________
4 If more students studied Aeronautical engineering, ______________
5 It would be difficult to test how a new aircraft performed if ______________

» Go to **Grammar reference** p.116

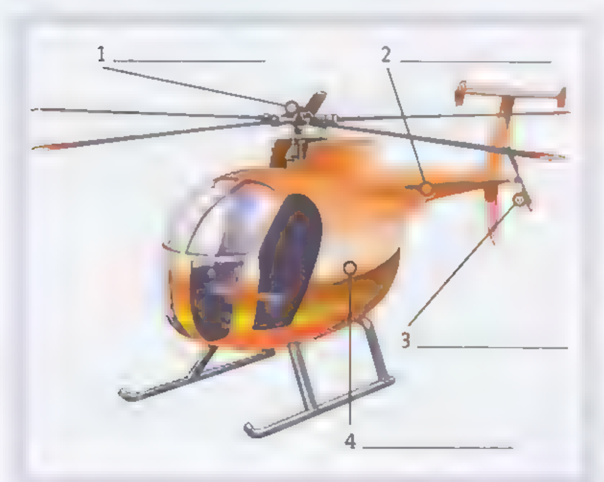
The *Spruce Goose*, built by billionaire Howard Hughes, was one of the biggest planes in history. It had a wingspan of 97.5 metres and was 24.2 metres high. It only ever flew 1 mile.

Pairwork

1 Work in pairs. Each of you has a diagram of a flying machine and a text about a different machine. Look at your diagram and think of questions you can ask your partner so that you can label it. Read the text. Ask and answer questions to label your diagrams.

Student A Go to p.111.

Student B



A glider is a non-powered heavier-than-air craft. To give the most efficient flight, gliders are as small and light as possible. The wings are longer and narrower than conventional planes. This extra wingspan means less drag for the amount of lift. Just as on conventional planes, ailerons provide roll, the elevators on the tail control pitch, and the rudder on the tail controls yaw. The horizontal stabilizer on the tail provides stability. After the launch, the glider achieves lift in three different ways. Rising columns of warm heat, called thermals, lift the glider. Hill or ridge lift is created by the wind blowing against a hillside and being forced upwards. Wave lift is created when air passes over a mountain.

As there is no engine, the pilot has to generate thrust in a different way. This is done by reducing altitude to gain speed.

2 With your partner, complete the table.

	Glider	Helicopter
How is lift achieved?		
Which parts provide thrust?		
How does the pilot achieve yawing?		
How does the pilot achieve pitching?		
What provides stability?		

3 What are the advantages of these two flying machines over conventional aeroplanes? List examples where these machines can be used where conventional aircraft could not be used.

Webquest

Jet engines

1 Look at the website and complete the table.
www.ueet.nasa.gov/StudentSite/engines.html

Engine part	Function
fan	
compressor	compresses air and so increases pressure
combustor	
turbine	
nozzle	

2 Using the same site, find out about different types of jet engine. Work in small groups. Each of you should choose a different engine. Make notes and then prepare a short presentation for your group to explain how it works and what it is used for.

Checklist

Assess your progress in this unit. Tick (✓) the statements which are true.

- I know key terms about flight
- I understand the difference between First and Second Conditional sentences
- I know how to check information on the phone
- My reading and listening are good enough to understand most of each text in this unit

Key words

Nouns
cockpit
drag
flaps
landing gear
lift
pitching
rolling
rotor
spoilers
stabilizers
thrust
trailing edge
wingspan
yawing

Verbs
approach

Note here anything about how English is used in technology that is **new** to you.

Make your point

Making telephone calls

1 Listen to the telephone call. Look at the note the secretary left for Mr Braun. How many mistakes has she made?

2 Work in pairs. Discuss how you could prevent misunderstandings on the phone.

3 Now listen to the second call. How does Mr Braun make sure the information is correct?

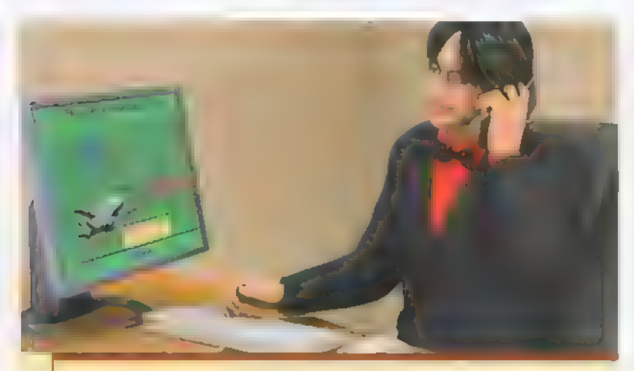
What is he going to do now?

4 Read the advice from Lee Avatar.

Telephone message

To: *M Braun*
From: *Frank Hall*
Date: *4th May*
Time: *10.30*
Message

Mr Hall called. Needs range for MD-11 – has range 6,840 for freighter
He's out after 4
011 246 639 0001
Signed: S Dobby



It's very important to make sure that you understand technical details, especially over the phone or radio. Ask the person to repeat if you are not sure and let them know you have understood, often you can do this by repeating what they have said. Here is some useful language.

Could you repeat that, please?
Sorry, I didn't get / catch that.
Did you say two thousand and six?
2,340? Is that right?
Could you spell that, please?

Now, work in pairs. Sit back to back. You each have two sets of information to give your partner over the phone. Use Lee's expressions. When you have finished, check that your partner has written down the correct details.

Student A Go to p.112. **Student B** Go to p.110.

7 Future homes

Switch on

Work in pairs. Discuss these predictions about future homes. Decide if they will happen within 15 or 75 years, or never.



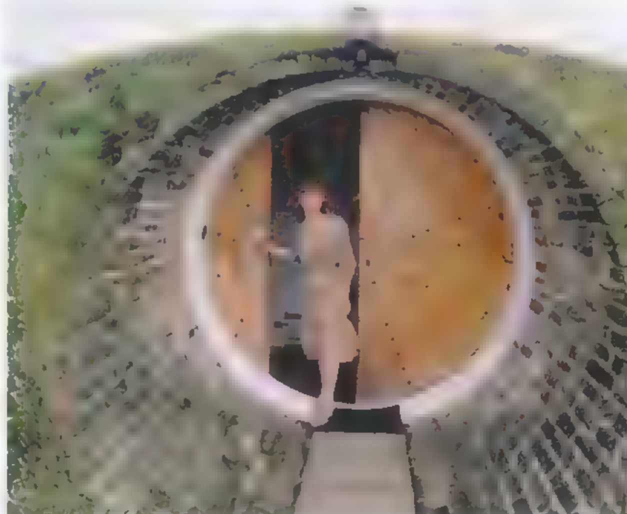
PREDICTION	15 YEARS	75 YEARS	NEVER
1 Many people will live in houses floating on the sea.			
2 Homes will produce their own water supply through condensation.			
3 At least 25% of homes will be self-sufficient in power.			
4 We will develop a house which is disaster-proof, capable of withstanding earthquakes, hurricanes, and flooding.			
5 Houses will be constructed largely from plastic.			
6 Houses will require very little maintenance such as painting.			
7 Many homes will be built underground or in part underground.			
8 You will be able to move internal walls and change the colour of rooms at the touch of a switch.			
9 Houses will generate their own electricity.			
10 Houses will have zero emissions.			

Listening

Earth homes

Listen to Peter Carpenter, a designer of earth homes, and tick the advantages he mentions.

a long life expectancy
b better energy savings than other designs
c architecturally exciting inside
d condensation is not a problem
e proof against earthquakes
f does not contribute to, and is less affected by, global warming
g costs no more – maybe less – to build than a conventional house
h unaffected by wind and weather
i kind to the environment
j provides greater security
k no draughts – minimum infiltration
l exceptionally low fire risk, so lower insurance premiums
m construction possible on steep slopes
n usually provides low visual impact
o very little structural maintenance
p quiet and private, but light and airy



In this unit
- ways to describe obligation and necessity
- adjective endings
- making inferences from written text
- transferring information from a text to a diagram

Language spot

Obligation and necessity

- Study these sentences:

1 *You don't have to paint the walls.*
= It's not necessary

2 *You have to get planning permission.*
= It's an obligation (required by law)

3 *The roof must be strong.*
= It's necessary

- We use *have to* to describe things which are obligations required by rules and regulations or things which someone forces us to do.

- Negatives and questions are formed with *do*.
***Do** you **have to** install air conditioning?*

- In positive sentences we can use *must* in a similar way, but the emphasis is because you think it is necessary.

- Note the difference between *don't have to* and *mustn't*:
*You **don't have to** spend a lot on heating an earth house.* = It's not necessary.
*You **mustn't** build an earth house without planning permission.* = It's not permitted.

» Go to **Grammar reference** p.117

1 Show the meaning of each of these sentences by marking them: *obligation, necessary, not necessary,* or *not permitted.*

1 You must use materials of the right standard. ______________
2 You don't have to use wood; plastic is acceptable. ______________
3 The walls must resist the pressure of earth round the building. ______________
4 You mustn't build within one metre of another building. ______________
5 You have to lay proper foundations. ______________
6 All electrical wiring has to be tested. ______________
7 You don't have to paint plastic window frames. ______________
8 All appliances have to be earthed. ______________

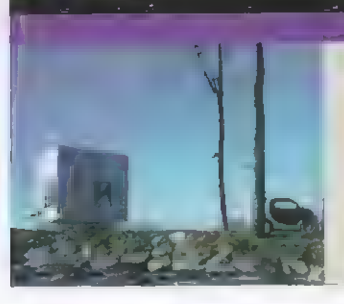
2 Complete the sentences with *must, mustn't,* or *don't / doesn't have to.*

1 The structure ______________ be strong enough to bear the weight of earth.
2 You ______________ let the house overheat.
3 You ______________ use stone for the front wall; brick is fine.
4 You ______________ make sure no water gets into the house from the surrounding soil.
5 Your house ______________ be deep under ground; 1.5m of earth above the roof is enough to fully insulate the building.
6 The weight on the roof is about 3 kN/m² so you ______________ use pre-stressed concrete roof beams.
7 The house is very well insulated, so you ______________ provide much heating.
8 There are strict rules about where you can build. You ______________ build without planning permission.

3 Make a sentence about each of these building regulations using an appropriate form of *must* or *have to.*

EXAMPLE
*Agricultural buildings **must not** be used for living accommodation.*

[illegible]	[illegible] regulations	
Agricultural		Not to be used for living accommodation
	1	At least 100 metres from a house
	2	Fire exit required
[illegible]	3	On site for no more than [illegible]
[illegible]	4	Sleeping accommodation [illegible] permitted
[illegible]	5	Planning permission [illegible] required
[illegible]	6	A [illegible]
	7	[illegible]



Gadget box

The microcompact house is a 2.66m cube with a timber frame and an anodized aluminium cladding. It contains two compact double beds, a shower/toilet, and a kitchen with sink, microwave, fridge, freezer, and hob. It is fitted with heating and air-conditioning. It weighs 2.2 tonnes.

Who do you think the microcompact home is intended for?

Vocabulary

Adjectives with *-able* and *-ible*

1 Many adjectives ending in *-able* or *-ible* describe the ability to do something. Complete the table. All the words have been used in this or earlier units.

can ...	adjective
be adapted	adaptable
be converted	
be seen	
be predicted	
last a long time	
be put into effect or made to work	
vary	

2 Now listen to the words and underline the stressed syllable. The first one has been done for you in the table above.

Reading

Inside the future home

1 Work in pairs. Make a list of ways in which homes of the future will be different from homes of today.

2 Study the diagram and read the associated texts. Compare your list in 1 with the information.

1 Wall-mounted flat screens will replace TVs. These will also act as computers and CCTV monitors for security cameras.

5 Interior walls will run on tracks so rooms can be used in different ways. Some partitions will be made of glass which becomes **opaque** when a current is passed through it.

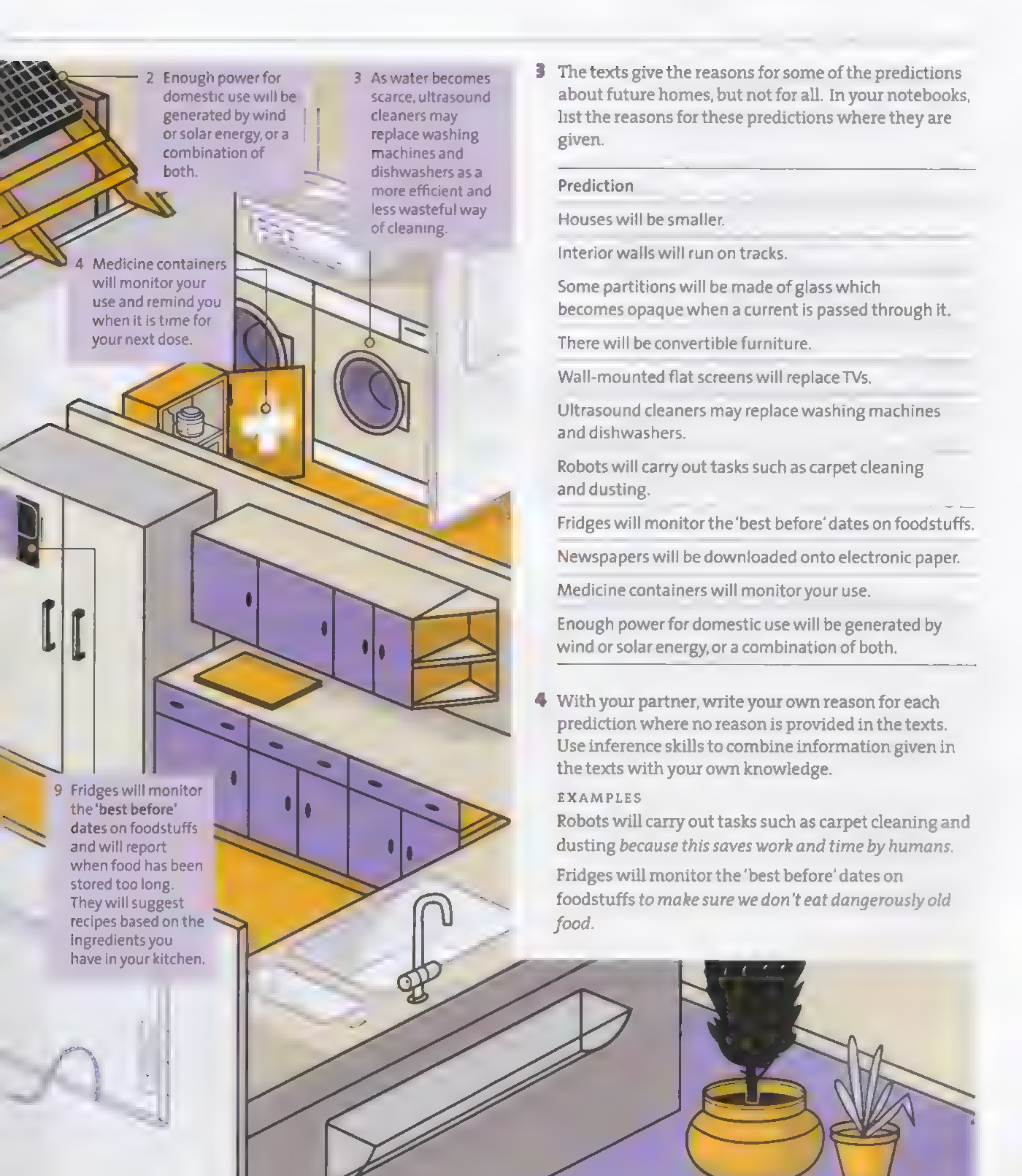
6 Newspapers will be downloaded on to electronic paper.

Houses will be smaller because of the increase in population and shortage of building land. They will be adaptable to meet the needs of their owners at all stages in life. New materials will be used to minimize maintenance and increase lifespan. We will fill our homes with labour-saving devices and smart technology to improve our health and comfort.

7 Robots will carry out tasks such as carpet cleaning and **dusting**.

8 There will be convertible furniture, such as sofa beds, which can be folded up when not needed.

opaque (adj) not clear enough to see through or allow light through
dust (v) clean surfaces with a cloth
best before date (n) date printed on a food package advising you the product will not be of such good quality after this date



3 The texts give the reasons for some of the predictions about future homes, but not for all. In your notebooks, list the reasons for these predictions where they are given.

Prediction
Houses will be smaller.
Interior walls will run on tracks.
Some partitions will be made of glass which becomes opaque when a current is passed through it.
There will be convertible furniture.
Wall-mounted flat screens will replace TVs.
Ultrasound cleaners may replace washing machines and dishwashers.
Robots will carry out tasks such as carpet cleaning and dusting.
Fridges will monitor the 'best before' dates on foodstuffs.
Newspapers will be downloaded onto electronic paper.
Medicine containers will monitor your use.
Enough power for domestic use will be generated by wind or solar energy, or a combination of both.

4 With your partner, write your own reason for each prediction where no reason is provided in the texts. Use inference skills to combine information given in the texts with your own knowledge.

EXAMPLES

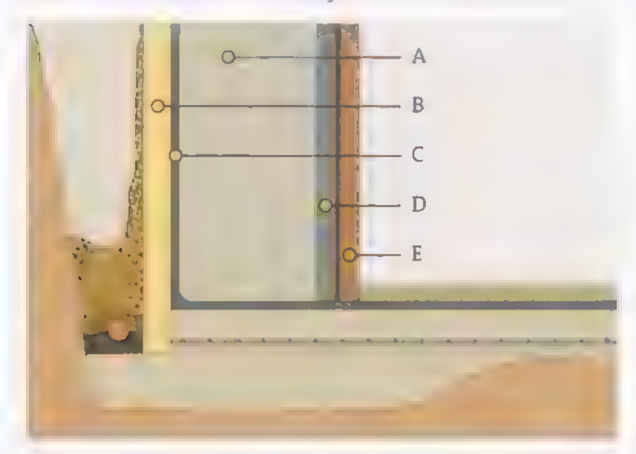
Robots will carry out tasks such as carpet cleaning and dusting *because this saves work and time by humans.*

Fridges will monitor the 'best before' dates on foodstuffs *to make sure we don't eat dangerously old food.*

In a country threatened by flooding, the safest place to be is actually on the water. Then your house just goes up and down.
Koen Olthuis, *floating house Architect*

Problem-solving

1 Look at the diagram of a section of wall used in an earth home. Try to guess what the key parts of the structure are and what they are made of.



2 Now label the diagram using the information contained in the text.

BACK AND SIDE WALLS

These are multileaf concrete and insulation. The outermost envelope, which is built first, is 150 mm concrete block (1) with a few supporting pillars outside. This acts as a permanent shutter for the heavy waterproof tanking membrane (2). Inside that is the main structural wall (3) made from 660 mm dense concrete block. The insulation comprises 100 mm slabs of expanded polyurethane (4) and these are fixed to the concrete wall with adhesive, all the cracks and joints being filled with aerosol PU foam. The insulation is protected with a vapour barrier of polythene and the final layer of 100 mm concrete or brick (5) is built inside that. These walls have to be very strong, completely and permanently waterproofed, insulated to the highest standards, and vapour-proofed from within to prevent deterioration of the insulation. The back wall is altogether just over 1m thick and is supported at 4m intervals by the structural counterforts which separate one room from the next.

Project

1 Work in groups, A, B, and C. The pictures show examples of accommodation designed for particular situations. Decide in your group what the situations are and how technology has been used to meet their requirements.

2 In your groups, research more about the buildings in **1** and make notes. The websites will give you plenty of information. Follow the links to find out as much as you can.

Group A www.gvshelters.com/

Group B www.monolithic.com/

Group C www.antarctica.ac.uk/living_and_working/research_stations/halley/halleyvi/

3 Form new groups of three with a person from A, B, and C. Tell your group what you have found out about the buildings.

B



C









Checklist

Assess your progress in this unit. Tick (✓) the statements which are true.

- I can transfer information from a text to a diagram
- I know ways to describe obligation and necessity
- I can make inferences when I read
- My reading and listening are good enough to understand most of each text in this unit

Key words

Adjectives
adaptable
convertible
self-sufficient
underground
well-insulated

Nouns
access
accommodation
condensation
environment
foundations
global warming
structure
ventilation

Verbs
construct
resist

Note here anything about how English is used in technology that is **new** to you.

8 Mass transportation

Switch on

Do the quiz.

1 Who invented the internal combustion engine?
  a Henry Ford
  b Etienne Lenoir
  c Nikolaus Otto

2 How much of the energy in petrol do petrol engines use?
  a Three quarters
  b One third
  c One fifth

3 Where was the world's first motorway built?
  a Germany
  b The USA
  c Japan

4 A shows a PRT system. What does PRT stand for?



A

  a Personal Rapid Transit
  b People Revolutionary Transport
  c Private Regional Transfer

5 Which sentence about *The Freedom*, the world's largest ship, is not true?
  a She will provide accommodation for 40,000 people.
  b She will rise 104m above the water level.
  c She will travel very quickly.

6 What is the unique characteristic of this 'Pendolino' in B?



B

  a It travels very fast.
  b It tilts as it travels round bends.
  c It travels on a single rail.

7 What is a Maglev?
  a a diesel train
  b an electric tram
  c a magnetic train

8 What type of boat does C show?
  a hovercraft
  b hydrofoil
  c surface-effect ship

C

Reading

Skimming

Skimming, or reading for general understanding, is a skill you need to develop for studying. By looking at the title of an article and any images – maps, diagrams, etc. – you can often get a general idea of what the article is about before you read.

1 Look at the title of the article and the pictures and decide what the article is about.

2 Now read the first underlined sentence in each paragraph: this should give an overview of the text. Decide which of the points in the table will be included in the text.

	Yes	No	Perhaps
how the parts of the A380 are transported			
how the A380 is manufactured			
where the parts are made			
about the French town of Toulouse			
about problems with moving the wing			
details about a ship			
about different forms of transport used to transport A380 parts			
about German manufacturers			
about cities in Europe			



In this unit

- skimming – reading for general understanding
- forming compound adjectives and nouns
- comparative and superlative review
- how to show enthusiasm in speaking
- how to persuade others

3 Now read the whole text quickly and check your answers.

4 Work in pairs. Without looking at the text again, see how much you can remember.

1 How many different methods of transport were mentioned?

2 Which countries were mentioned?

3 Why is it difficult to transport the parts of the aircraft?



A European project

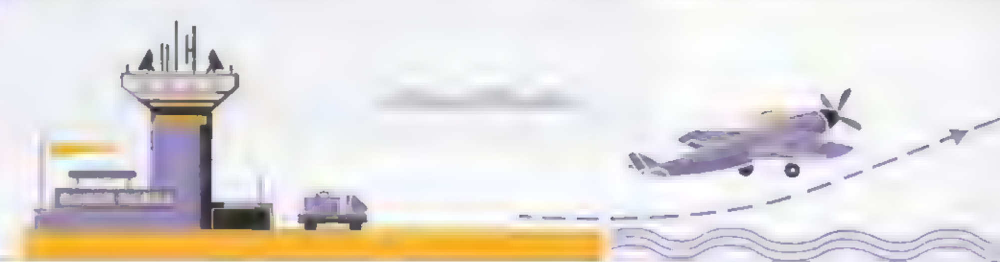
The main parts of the Airbus A380 are manufactured in different locations in Europe, with the final assembly in Toulouse, France. The parts have to be transported to Toulouse using a variety of methods. Because of its size, the Airbus A380 requires the biggest wings ever constructed and it is a major undertaking getting them to Toulouse from the west coast of Wales in the UK.

At the UK factory, the wing is lifted into a jig that supports it on its journey. This jig is placed on a 96-wheel, 200-tonne multi-purpose vehicle (MPV). This unmanned vehicle is controlled from a mobile console carried by the operator as he walks ahead of the load. Cables are buried in a groove in the road. It is 1.7 km by road to the river Dee. Here the wing is moved onto a specially-built, flat-bottomed river craft that extends only 2m below the waterline. This craft transports the wing downriver to the port of Mostyn on the coast.

A new roll-on / roll-off vessel called the *Ville de Bordeaux* has been specially built to transport the sections of the Airbus to the French port of Pauillac. The ship is 154m long and 24m wide. It has a cargo deck space of 6,720m and the largest water-tight stern door (22m x 14m) ever built. It is equipped with a system of internal ramps, doors, and hoistable decks to accommodate the aircraft components, and travels at an average speed of 16 knots.

Fuselage sections manufactured in northern Germany are transported aboard the *Ville de Bordeaux* from the factory in Hamburg. The vessel stops en-route at Mostyn to load the wing before continuing to the French coastal town of St Nazaire. Here the complete forward fuselage with cockpit and a complete centre fuselage are loaded on board. At the town of Pauillac, the vessel berths alongside a specially-constructed quay with the stern aligned to a 150m floating pontoon. Here the parts are transferred onto specially-constructed barges to be taken down the river Garonne to Langon, 95 km away. A new dock has been built here so the water depth can be adjusted to enable the barges to unload their cargo onto new road transporters. These vast new computer-guided lorries take the parts 240 km to Toulouse along roads that have had to be widened and straightened to accommodate the convoy

The shortest regular scheduled flight is between two of the islands in Orkney in the north of Scotland. It takes only 2 minutes



Vocabulary

Compound adjectives and nouns

Two words can be joined together to make a compound adjective, which is usually written with a hyphen.

1 To help you remember new vocabulary, try to learn words in phrases. Find these compound adjectives in the text and write down the noun they describe.

EXAMPLE

computer-guided lorry

multi-purpose ________

roll-on ________

96-wheel ________

2 Match a word in A with a word in B to make compound adjectives.

A	B
air	controlled
remote	breaking
long	in
built	going
ocean	conditioned
record	distance

3 Choose a compound noun to complete the sentences

airbag	powerboat	seabed
Boat-builder	radio signal	traffic congestion
container ship	safety belt	waterline

1 Passengers travelling in a car are obliged to wear a ________

2 John works as a ________ for a small company making sport and leisure boats.

3 When the ________ is weak, reception is poor.

4 Most goods that are transported at sea are packed into containers that are loaded onto a ________

5 Part of the hull of a ship sits below the ________

6 In city centres and on major roads ________ has become a major problem.

Pairwork

1 Work in pairs. Discuss the last time you travelled by train. Why did you take the train? Do many people choose to travel by train in your country? Why? / Why not?

2 Look at the pictures. What types of train are these?



Each of you has some information. Ask and answer questions to complete the table.

Student A Go to p.112.

Student B Go to p.110.

	Maglev train	Bullet train
Country		
Max speed		
Technology		
Fuel		
Track		
Efficiency		

3 Discuss the advantages and disadvantages of Maglev and Bullet trains. Make notes.



Language spot

Comparative and superlative review

- How much do you remember about comparative and superlative adjectives?

1 Circle the correct form.

1. *Air travel is* **quicker / more quicker** *than travelling by car.*
2. *It's* **most dangerous / more dangerous** *travelling by car than by train.*
3. *Passengers are usually* **happier / more happy** *to pay for quick connections than beautiful interiors.*
4. *501 km/h was the* **fastest / most fast** *speed achieved by a Maglev train in 2003.*
5. *City planners must try to find* **more efficient / the most efficient** *form of public transport.*
6. **The cheapest / The less expensive** *form of transport is not always the* **good / best** *answer.*

- Can you explain the rules? Go to *Grammar reference p.118* and check your answers.

- To talk about the similarities or differences in more detail, we can use adverbs before the comparative structure.

2 Underline the adverbs in this paragraph.

Compared to ships and road vehicles, Maglev trains move passengers and goods at much higher speeds and considerably lower cost. They also use a good deal less energy. Compared to air transport, Maglev trains move passengers and goods at a lot less cost and in much more volume. Overall, Maglev technology is a much better way to move people and goods than existing modes. As well as being a great deal cheaper and a lot faster, it has a far longer service life.

- The adverbs in the paragraph refer to large differences. Can you think of adverbs we use to refer to small differences?

slightly ____________ ____________

Which adverbs are more informal?

» Go to **Grammar reference** p.118

3 A group of people were asked to rate car, bus, and walking as forms of transport. Look at the table and the example below. Then write sentences to compare the other features.

	Car	Bus	Walking
Safety	✓	✓✓✓✓	✓✓
Cost	£££££	£££	–
Pollution	✗✗✗✗✗	✗✗✗	–
Convenience	✓✓✓✓✓	✓✓✓	✓
Journey time	✓✓✓✓✓	✓✓✓	✓

EXAMPLE
Travelling by car is the most dangerous form of transport. Walking is slightly safer, but it is considerably safer to travel by bus.



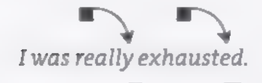
Mark my words, a combination airplane and motorcar is coming. You may smile, but it will come
Henry Ford *1940*

Pronunciation

Showing enthusiasm

We can show how enthusiastic we are in the words we choose and in the way we speak.

1 Listen to how we can use *really* or *absolutely* to make a strong adjective stronger.
The story of the Airbus A380 is really fascinating
When you stand near it, you realize it's absolutely enormous.
Notice how we pronounce *really*, *absolutely*, and a strong adjective.



I was really exhausted.

I was absolutely exhausted.

2 Work in pairs, A and B. Take turns to read the sentences below. Reply to each one using *really* or *absolutely* and an adjective from the box. Remember to sound enthusiastic!

delighted	fascinating	terrified
enormous	luxurious	unbelievable
essential	marvellous	

EXAMPLE
A *The story of the Airbus is interesting.*
B *Yes, it's really fascinating.*

Student A

1 The story of the Airbus is interesting.
2 Have you seen the new Airbus A380?
3 They have had to rebuild roads and develop new quays to transport the parts.
4 My new car has satellite navigation.

Student B

5 Is public transport important for reducing carbon emissions?
6 Most cruise ships are like five-star hotels.
7 You must have been pleased to win the designer of the year award!
8 Did you enjoy travelling at 430 km/h on the Maglev?

Now change and do the exercise again.

Its my job

1 Listen to an interview with Matt Haydon, a Marine Engineer, and put the questions in the correct order.



a What hours do you work on the ship? ______
b Are there any risks? ______
c What's your job? ______
d So, what sort of training did you have to become a Marine Engineer? ______
e Would you recommend this job to others? ______
f How much time do you get off? ______
g What are you responsible for in your job? ______
h What's the most challenging part of the job? ______

2 Listen again and answer the questions in **1**.

3 Discuss with a partner.
1 Would you like to do this job?
2 Would you like to work for fourteen weeks and then have fourteen weeks' holiday?
3 Why do you think it is 'still a man's job'?

Make your point

Persuasion

1 Jo Illich wants to persuade a group of town planners to accept his solution to ease traffic congestion in his city. He decided to visit Lee Avatar to help him prepare his presentation. This is the checklist Lee sent to Jo.



- Prepare well. Gather all the relevant details. You must have all the necessary facts and figures, and they must be correct.
- Give sufficient background information, but don't bore your audience.
- Be prepared to give clear reasons for each suggestion.
- It's best to prepare printouts giving detailed financial and technological data. That allows the audience to read at their own speed and to refer back when necessary.
- You should sound enthusiastic. Smile and make eye contact.
- Don't be afraid of silent pauses while you put visuals in place.
- Don't rush! Take your time and speak clearly.
- Be prepared for questions!

2 Listen to Jo's presentation and look at Lee's checklist. Use the checklist to evaluate Jo's performance and discuss with a partner how persuasive he was.

3 Work in small groups. Prepare a short, persuasive presentation about the advantages of a mode of public transport. Think about noise and air pollution / energy efficiency / safety and comfort / land use / journey time.

Give other students feedback on their presentations based on the checklist.

Checklist

Assess your progress in this unit. Tick (✓) the statements which are true.

- I can form compound adjectives and nouns
- I can form comparatives and superlatives
- I know how to express enthusiasm when speaking
- I know what is important when trying to persuade others
- My listening and reading are good enough to understand most of each text in this unit

Key words

Adjectives
fascinating
magnetic
proposed

Nouns
barge
cargo
congestion
container ship
goods
location
motorway
passenger
public transport
rail
statistics
vessel

Note here anything about how English is used in technology that is **new** to you.

Writing bank

Emails

1 Are these statements about emails true or false?

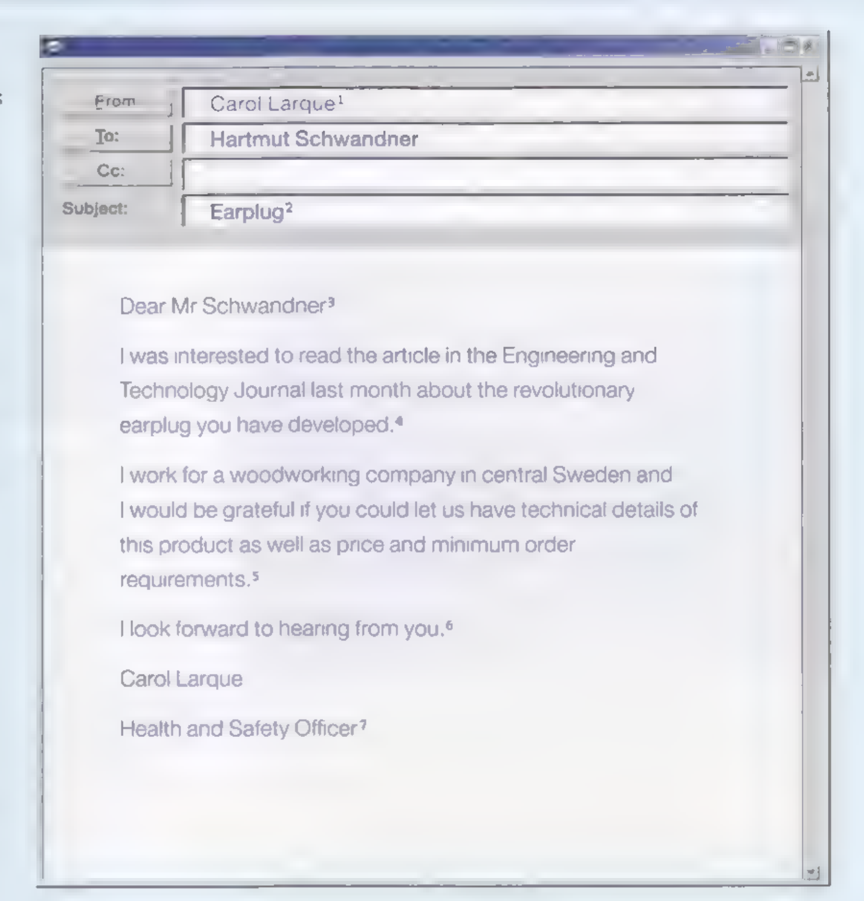
1 If you know the recipient well, you can leave out the opening greeting and complimentary close.
2 Emoticons :-) ☺ can be used in any type of email.
3 To stress a word, write it in CAPITAL LETTERS.
4 You should keep your message short.
5 It's not necessary to answer an email quickly.
6 You should never write something you don't want others to see.
7 You should try to be amusing.

2 Read the email and answer the questions.

1 Who is Carol Larque?
2 Who is Hartmut Schwandner?
3 What does Carol want?
4 Why does she tell Hartmut where she works?

3 Match the parts of the email 1–7 with the sections a–g.

a Reason for writing
b Sender's position
c Subject line
d Complimentary close
e Sender's name
f Opening greeting
g How Carol knows about Hartmut



From: Carol Larque[1]
To: Hartmut Schwandner
Cc:
Subject: Earplug[2]

Dear Mr Schwandner[3]

I was interested to read the article in the Engineering and Technology Journal last month about the revolutionary earplug you have developed.[4]

I work for a woodworking company in central Sweden and I would be grateful if you could let us have technical details of this product as well as price and minimum order requirements.[5]

I look forward to hearing from you.[6]

Carol Larque

Health and Safety Officer[7]

4 Read the two emails and answer the questions.

1 How does Per begin the main body of the email?

2 How does Per make polite requests?

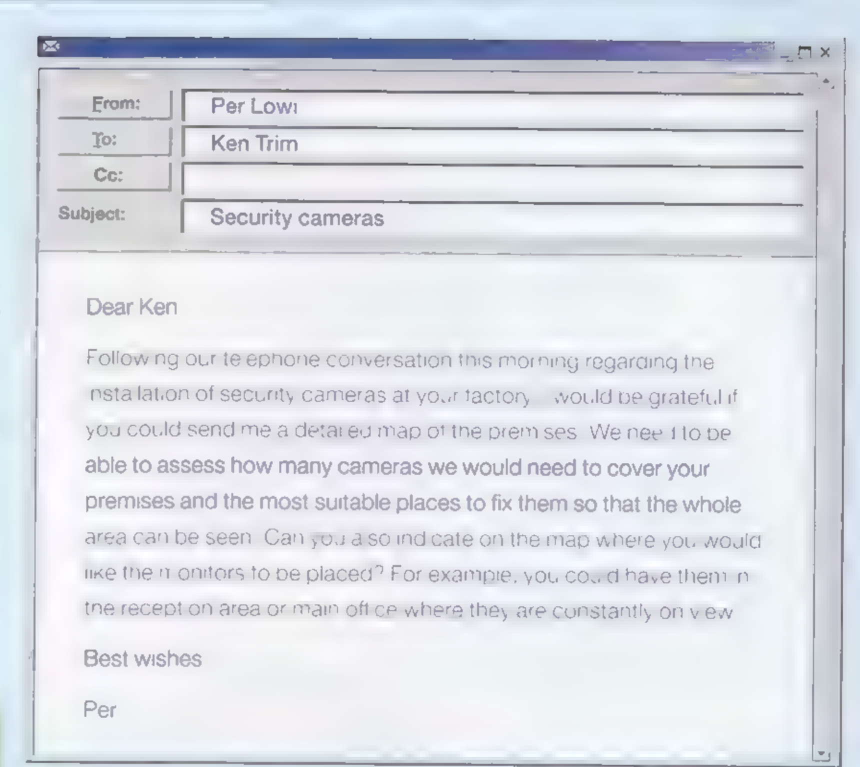
3 How do Per and Larrie open and close their emails? Which one of them knows the person they are writing to?

5 **A** Write an email to ask for technical information about the heat pumps advertised in *The Energy Journal* last week. You also want to know about the cost and details for installing them. You think you could install it yourself. Ask about the length of the guarantee. Write 70–90 words.



If you are looking for a safe and environmentally-friendly alternative to fossil fuels, heat pumps are the answer. Heat pumps provide the safe solution to heating the house and reduce costs by up to 70%.

B Write an email to Plastics Incorporated asking for details of their apprenticeship or young graduate schemes. Write 35–50 words.



From: Per Lowi
To: Ken Trim
Cc:
Subject: Security cameras

Dear Ken

Following our telephone conversation this morning regarding the installation of security cameras at your factory, I would be grateful if you could send me a detailed map of the premises. We need to be able to assess how many cameras we would need to cover your premises and the most suitable places to fix them so that the whole area can be seen. Can you also indicate on the map where you would like the monitors to be placed? For example, you could have them in the reception area or main office where they are constantly on view.

Best wishes

Per

From: Larrie Dale
To: info@barrierdesigns.com
Cc:
Subject: Catalogue

Dear Sir/Madam

As a consultant to the oil industry I am very interested in your safety products. Could you please send me your catalogue and latest price list? We are particularly interested in providing our customers with effective gas detection systems.

I look forward to hearing from you.

Yours faithfully

Larrie Dale

Dale Products
Tel: 001 519 1557 323232
24 Alberta Road, Newington, London, Ontario

Describing graphs

1 Complete the tables with the words below.

considerably	increased
decreased	moderately
dropped	sharp
gradually	slowly
growth	steep
increase	went up

2 Look at the graph in Fig. 4.

1. What is the topic of the graph?
2. What does the horizontal (X) axis represent?
3. What are the figures on the vertical (Y) axis?
4. What were the most important sources of energy? Why are 1978 and 1983 significant? What do you notice about alternative sources of energy? Which source of energy grew significantly after 1970?

3 Read the description of the graph in Fig. 4.

1. What is the purpose of the first sentence?
2. What is the purpose of the second sentence?
3. Which words have a meaning similar to *approximately*?

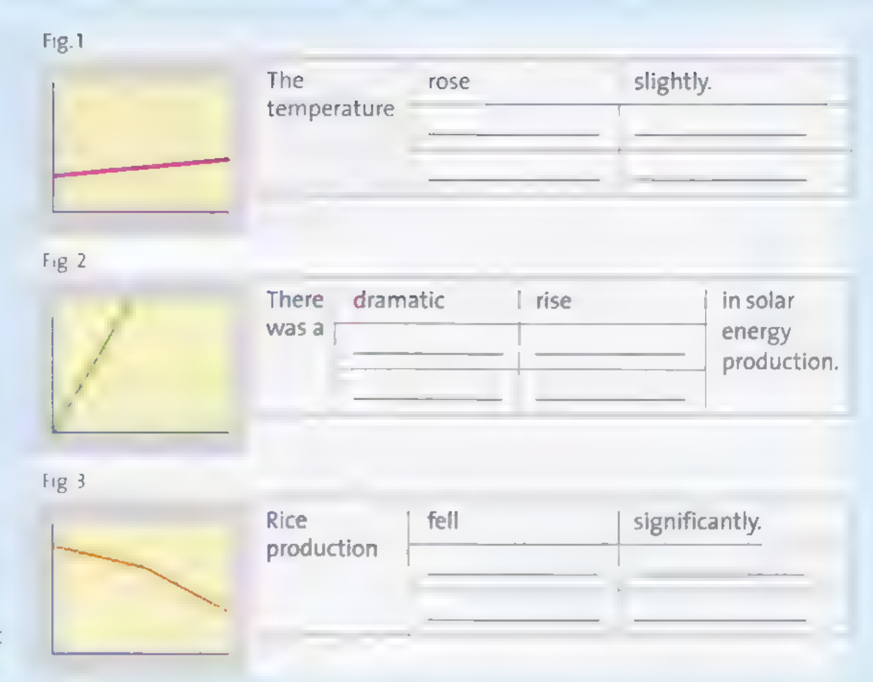


Fig. 1

The temperature	rose	slightly.

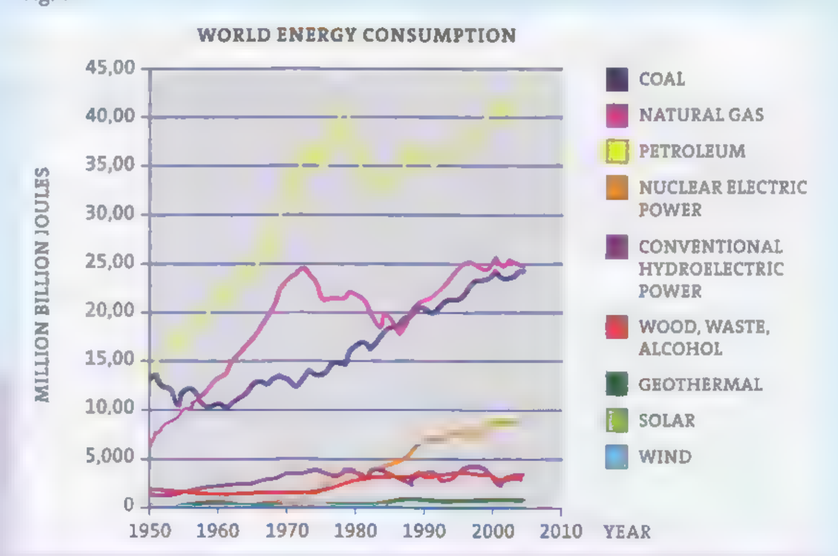
Fig. 2

There was a	dramatic	rise	in solar energy production.

Fig. 3

Rice production	fell	significantly.

Fig. 4



The graph in Fig. 4 shows how much energy from different sources was used between 1950 and 2005. We can see that over this period the amount of energy used increased sharply and the largest amount of energy came from petroleum. In 1950 just over 13,000 million billion Joules was used but this figure rose sharply to reach a peak of roughly 40,000 million billion Joules in 1978. There was a dramatic fall to just over 30,000 million billion in the following five years before rising rapidly to reach 42,000 million billion Joules by 2005. The second and third largest sources of energy were natural gas and coal, which each accounted for about 25,000 million billion Joules in 2005. The graph shows that insignificant amounts of energy came from renewable sources during this time, but there was a growth in the amount of nuclear electric power after 1970, reaching approximately 8,000 million billion Joules in 2005. The fall in energy consumption in the years around 1980 was probably due to the world oil crisis.

4 Look at the pie charts in Fig. 5.

1 What do they show?

Read the description of the pie charts.

2 What does *respectively* mean?

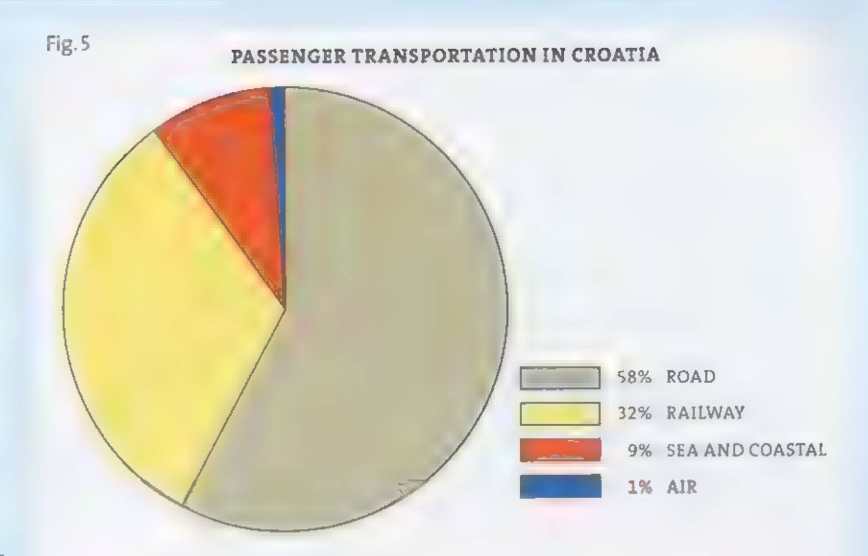
3 The word *while* is used to contrast two pieces of information. Find two other words which have the same function.

5 Choose the correct answer.

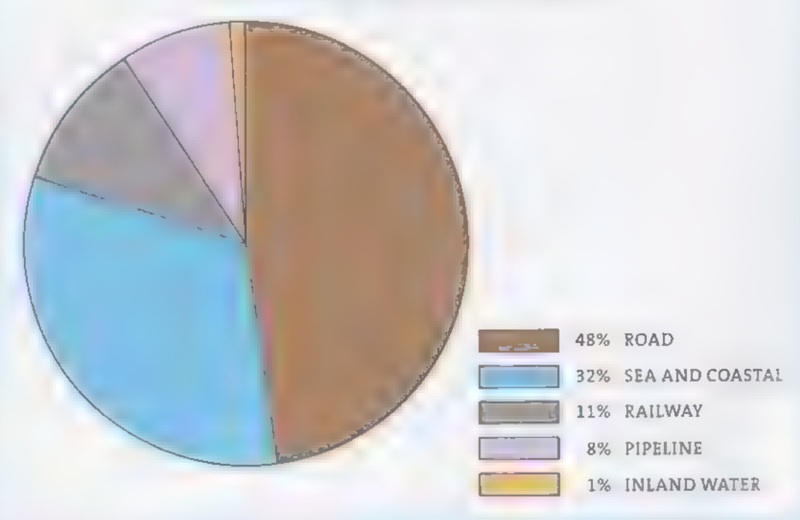
A *line graph / pie chart* shows a relationship between two variables. The variable on the X axis is often time. We use a *line graph / pie chart* to show increases and decreases.

A *line graph / pie chart* is divided into sectors which represent a percentage of the whole. We use a *line graph / pie chart* to compare and contrast data.

Fig. 5







The pie charts compare the use of different modes of passenger and cargo transportation in Croatia. It can be seen that more than half of all passengers choose to travel by road, accounting for 58%, while just under half of all cargo is carried by road. About a third of all passengers use rail transport but only 11% of Croatia's cargo goes by rail. Croatia has a long coastline and just under a third of Croatia's cargo is transported by sea. However, only 9% of passengers use this form of transport. This is probably because sea transport is cheaper for cargo but too slow for passengers. Pipeline and inland water transportation account for 8% and 1% of cargo transportation respectively.

6 **A** Use expressions from the *Clipboard* to write a description of the graph in A. In your first sentence describe what the graph is about by using the title, X, and Y axis. In the second sentence give an overview of the trends shown in the graph. Then describe the graph in more detail. Write 80–100 words.

B Write a description of the pie chart in B. Write 80–100 words.

Clipboard

Language for describing graphs

The graph shows

The graph provides information about

The chart compares

Between 2004 and 2006

From 2004 to 2006

Over this period

In 2005

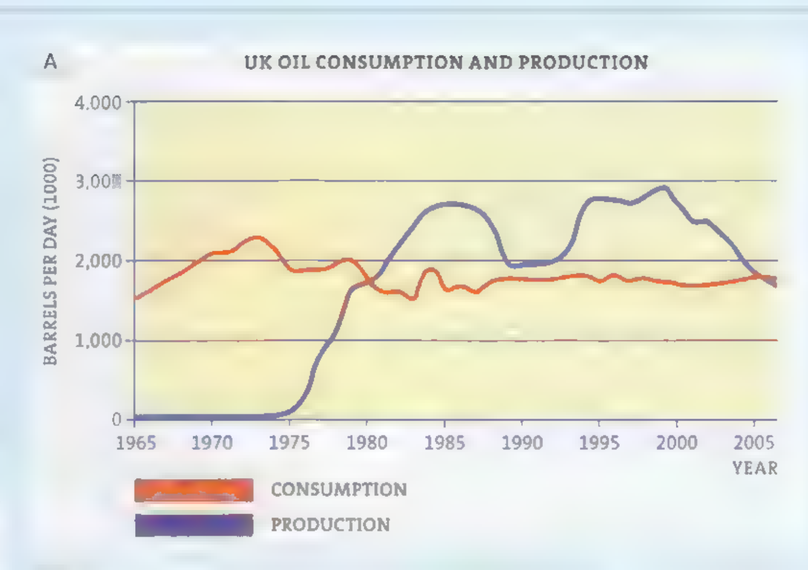
During this time

Reach a peak

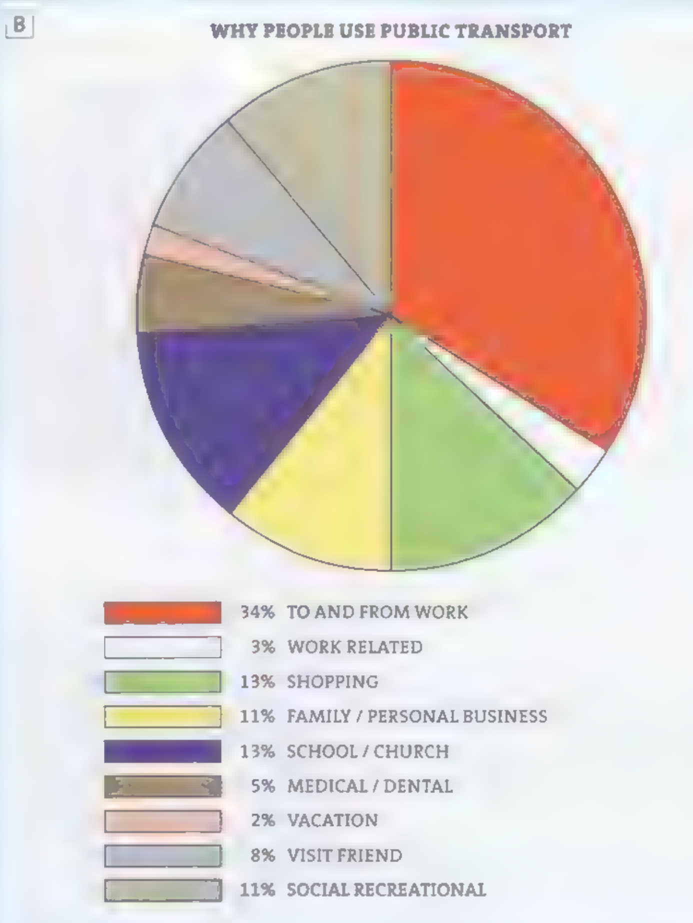
Account for

7 Carry out a class survey of the method of transport used by students to get to class. Display the results in a pie chart and then write a description.

A



B



CV (Curriculum Vitae)

1 Read Marc's CV. He is applying for graduate schemes specializing in Environmental consultancy and Impact assessment. Answer the questions.

1. Which school did he go to?
2. What subjects did he study at school?
3. At which university did he study?
4. What subject did he study?
5. What did he do while he was in Germany?
6. Where is the Eden Project?
7. What did he do there?
8. What does he think his strengths are?
9. What does he do in his free time?

2 Write a CV for yourself. In your CV you have to sell yourself. Unit 15 will give you ideas of different skills. Once you have completed the CV, write a covering letter to go with it.

Marc Foster
D.O.B. 03.06.1986
Email: mfoster@worldwide.co.uk
Tel: home 01295 670026 mobile 07884128831
Nationality: British

Profile
I am a highly motivated and hard working young graduate with excellent academic qualifications and appropriate work experience in the field of ecology. I work very well in a team, have excellent communication and organizational skills, and enjoy encouraging and motivating others, including children.

Education and qualifications

2005 – 2008 University of Leeds
BSc (Hons) 2.1 Environmental biogeoscience
My personal research project on collecting biodata in the river Danube floodplain is to be published by the Worldwide Fund for Nature in their quarterly magazine.

Modules studied
Environmental Risk: Science, Policy, and Management
Air quality: Science and Policy
Earth System Science: Biochemical Cycles
Soils and Environmental Change
Sustainable Development: Challenges and Practice

1998 – 2005 Polam Hall School, Darlington
AS level: Business studies (C), General Studies (B)
A2 level: Chemistry (B), Mathematics (A), Biology(B)
9 GCSE grades: 2A*, 4A, 2B, 1C

Work Experience

July/August 2006, 2007 Worldwide Fund for Nature, Germany
Total of 12 weeks spent assisting with species and habitat management, surveying and monitoring activities, and the collection of biodata. This provided valuable experience of ecosystems as well as working in an international team.

Summer 2004, 2005 The Eden Project, Cornwall
Summer assistant with responsibility for selling tickets, guiding visitors around the centre and assisting with educational activities for children. This helped me develop my skills working with children and members of the public as well as explaining issues related to the environment.

Interests
I take great pleasure in travelling to experience different cultures, meet new people, and learn from new experiences. I enjoy playing the piano and singing. I have been a member of the university operatic society for the last three years.

Memos

1 Read the memo and answer the questions.

1 What is the purpose of the memo?

2 How will apprentices be chosen?

3 What should the team leaders in the Maintenance Department do now?

Clipboard

A memo is an internal company document that is normally impersonal and formal in style. It can be sent to one person or a number of people within the organization and may be put on a noticeboard. It should:

state who it is to

state who it is from

have a title explaining what it is about, and a date

state the purpose in the opening paragraph

be as brief as possible.

KEYSTONE ENGINEERING

122 – 128 Highland Street
Newby

Tel: 0044 547 222234
email: enquiries@keystone.co.uk

Memo

To	Maintenance Department
From	Training Manager
Subject	Six Apprenticeship places starting September 2008
Date	14 May 2008

A decision has been made by senior management that apprenticeships for six Maintenance Technicians will be made available to start in September 2008. Advertisements inviting applicants will be placed in national newspapers in June. Interviews will be arranged for the week beginning 3 July.

The apprenticeships will be for three years and will consist of on-the-job training under supervision in the Maintenance Department and day release one day a week to the local college.

Would team leaders please attend a meeting in room D on Thursday 17 May at 9 a.m. to discuss possible skilled supervisors for the apprentices and the apprentices' work rotation.

2 Complete the memo by putting the information a–f in the correct place.

a all transport vehicles will be fitted with GPS navigation system equipment

b Short briefing courses

c Would all drivers please sign up

d Memo

e so improve the efficiency of our delivery service

f Transport Department

3 A Write a memo to all staff working in the Food Department at Briteways Supermarket. Use the notes in A below. Provide a company address, date, etc. Write 80–100 words.

B Start Engineering have recently signed a contract with a German company, Poch AG, to supply them with components for the next three years. A group of Senior Managers from the company are coming to visit Start Engineering. Write a memo to all staff using the notes in B below. Write 70–90 words

[illegible]

Kirby North Industrial Estate
Kirby

____________[1]

To	____________[2]
From	General Manager
Subject	GPS vehicle navigation system for all delivery vehicles
Date	24 November 2008

As part of the company efficiency programme, ____________[3] over the next few weeks. This equipment will allow drivers to find their way to delivery addresses more quickly and ____________[4].

____________[5] on how to operate the equipment will be run on Monday 4, Tuesday 5 and Thursday 7 December at 8.30 a.m.

____________[6] for one of these dates with their group manager.

A

Change in fruit and vegetable packaging – will stop using plastic trays.

New trays compostable, starting next month

Less attractive so staff need to reassure customers

Company advertising campaign to promote them as environmentally-friendly next month

Everyone to attend short training session Friday 1p.m., room D

Those unable to attend, speak to line manager

B

visit 10 – 13 April

be prepared to answer technical questions – be helpful

be prepared to explain production procedures – be informative

arrange lunch and rest breaks so there is always someone available to answer any technical questions

Instructions

1 Match the hand signals with the instructions to the driver.

Lower
Move forward
Move backwards
Raise
Stop



2 What instructions do these signs give?

EXAMPLE
A *Do not smoke.*

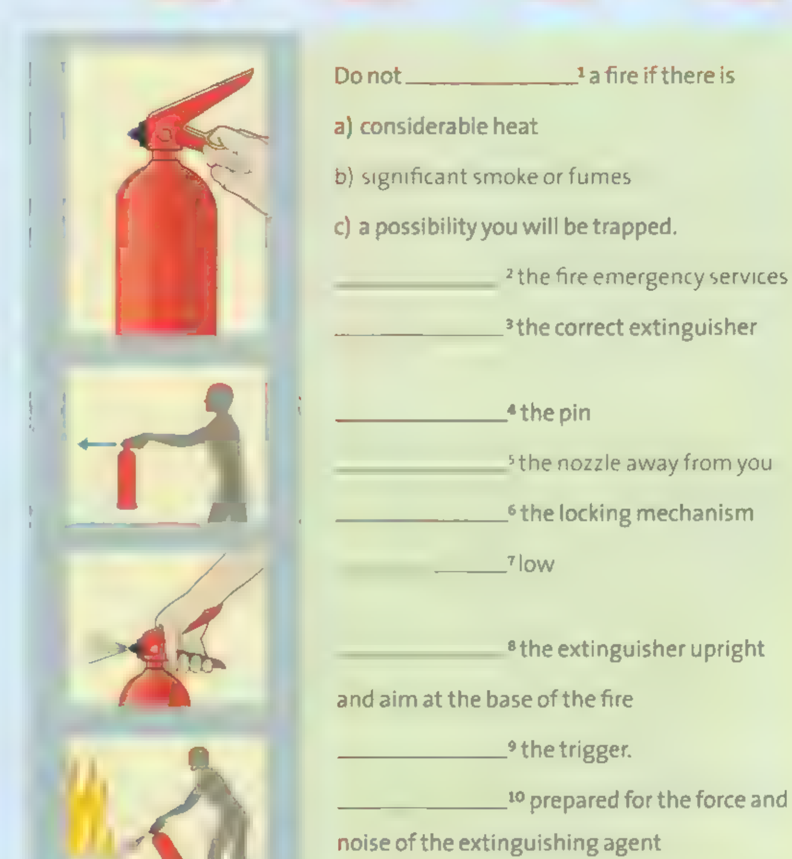
When we give instructions, we use the infinitive of the verb. To give a warning or prohibit an action we use *do not*.

3 Have you ever used a fire extinguisher? Would you use the same extinguisher for an electrical fire as for a paper fire? Why?/Why not?

Find the nearest fire extinguisher to your room and read the type of fire it is suitable for.

Use the words below to complete the instructions for using a fire extinguisher.

Aim	Point
Be	Pull out
Call	Release
Choose	Squeeze
Fight	Sweep
Hold	



Do not ____________[1] a fire if there is

a) considerable heat

b) significant smoke or fumes

c) a possibility you will be trapped.

____________[2] the fire emergency services

____________[3] the correct extinguisher

____________[4] the pin

____________[5] the nozzle away from you

____________[6] the locking mechanism

____________[7] low

____________[8] the extinguisher upright and aim at the base of the fire

____________[9] the trigger.

____________[10] prepared for the force and noise of the extinguishing agent

____________[11] the nozzle from side to side

4 Look at the sketches that show how to make a solar oven. Write a set of instructions on how to build a solar oven to accompany the illustrations. Include all the parts and materials from this list:

main structure
plywood or other board material
interior
black painted metal
lid
glass
reflective panels
aluminium foil
corrugated cardboard

Write 50–70 words.



Clipboard

Useful verbs

Place	*Attach*
Connect	*Cut*
Paint	*Measure*
Cover	*Use*
Estimate	*Fix*
Calculate	*Try to*

Health and safety

1 Look at part of a completed accident report form.

1 Who was injured?

2 How old is he?

3 What were his injuries?

4 Why do you think the driver didn't see the boy?

Clipboard

Language of injuries

He cut his hand and needed stitches.

She broke her leg/had a broken leg.

He was knocked unconscious.

He burnt his arm.

She has a bruised face.

He was knocked down by a car.

He slipped on/tripped over ...

He suffered a major injury/ a broken neck.

When we write an incident report we use past tenses.

Jolan Balog saw ...	Past Simple
Abdul was hit ...	Past Simple (Passive)
Abdul had entered ...	Past Perfect

Name of injured person	*Abdul Azizi*
Address	*Flat 267, Block 65, New City, Birmingham*
Phone number	*0121 121212*
Age	*9*
Female/Male	*Male*
Job title	*not applicable*
Who was the injured person?	
Employee	
On training scheme	
On work experience	
Employed by someone else	
Self-employed	
Member of the public	✓
Kind of accident	
Contact with moving machinery	
Hit by moving object	
Hit by moving vehicle	✓
Hit something fixed	
Injured while handling, lifting, carrying	
Slipped, tripped, fell	
Trapped	
Drowned	
Exposed to harmful substances	
Exposed to fire	
Exposed to electricity	
Injured by animal	
Physically assaulted by a person	
Description of what happened	*Abdul was hit by a moving dumper truck which was carrying earth on the construction site in Main Road. The truck driver did not see Abdul, who had entered the site. Jolan Balog, Site Foreman, saw the accident and called an ambulance. Jolan and two other workers stayed with Abdul until the ambulance arrived. At hospital, Abdul was X-rayed and found to have a broken leg and bruised arms*

2 Dan Skrebowski, 22, has been involved in an accident at work during his training in electrical installation. Look at the pictures below, and then fill in the report form. Use imaginary personal details for Dan. Use the expressions in *Clipboard* and the Past Simple to describe his injuries. Write 60–80 words.

About you, the person filling in the report	About the person who had the accident
Name ______	Name ______
Address ______	Address ______
Occupation ______	Occupation ______

Signature ______ Report number ______ Date ______

About the accident

When did it happen? Date: ______ Time: ______

Where did it happen? ______

How did it happen and why? ______

______

Give details of any injury suffered and treatment given ______

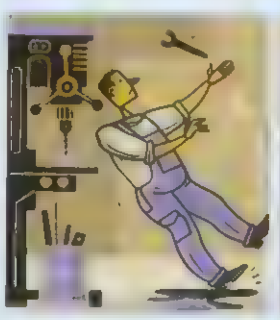
______

Give any recommendations to avoid similar accidents occurring

______

______

______







Health and Safety report

3 An Accident Investigation Inspector has produced a Health and Safety report following Abdul's accident. Match the paragraphs A–D with the correct part of the report 6.1–7.2.

A Vehicle access points to the site should be manned during construction work to prevent persons accessing the site when gates are open.

B Vehicle access points to the site were constantly open and unmanned.

C Site should be securely fenced off to prevent unauthorized access by members of the public. Any breaks should be fixed immediately.

D Site had not been securely fenced off. Temporary fencing had fallen over in two places and had not been put back up.

6.0 Findings

6.1

6.2

7.0 Recommendations

7.1

7.2

4 Write the findings and recommendations sections of a report following Dan's accident. Write 60–80 words.

Reports

1 Complete the short description of what reports are for with the words below.

issue purpose
describes written
possible

A report ____________¹ a study, investigation, or project. Its ____________² is to provide recommendations, updates, and sometimes to sell an idea. It is ____________³ by a single person or group of people who have investigated the ____________⁴ and it is read by people who require the information. It should be as long as necessary and as short as ____________⁵!

2 Read the extracts from a report. Match the items below with the extracts. Two have been done for you.

a Title ____
b Table of contents ____
c Introduction ____
d Body of the report ____
e Comparison ____
f Summary and Conclusion _6_
g References _3_

1 The treadle pump uses simple technology to raise water from underground sources. Fuel is not …

On the other hand, the diesel pump has the advantage of being able to pump larger quantities of water (see appendix 1.1). It

2 Because rain only falls during certain months of the year and there is only limited finance available, it is essential to find an irrigation system that is cost-effective.

The aim of this report was to find the most suitable method of raising ground water, with the main criteria being cost, low maintenance, and ease of use.

This report presents two irrigation systems: the treadle pump and the diesel pump.

A description and an analysis of operational efficiency for each pump are followed by a comparison of the two designs. Finally the most effective pump is recommended.

3 Appendix 1 – table showing comparative figures

4 2.0 Treadle pump
2.1 Operation
The treadle pump is operated by a person using his/her body weight and leg muscles in a walking movement to pump the water. …
The pump consists of two pistons positioned inside two cylinders. …

5 Summary
1.0 Introduction
2.0 Treadle Pump
2.1 Operation
2.2 Costs
3.0 Diesel pump
3.1 Operation
3.2 Costs
4.0 Comparison
5.0 Recommendation and Conclusions
6.0 References
Appendices:
Appendix 1

6 In conclusion, two alternative designs have been presented: a low-cost treadle pump and a diesel-generated pump. Each is low in basic cost and easy to …, however, the treadle pump is recommended as it presents lower maintenance costs and …

7 A comparison of two irrigation systems for small farmers in rural Africa

By Frank Burton and Ailsa MacLeod
24 July 20__

3 The Summary/Abstract

The summary is often called an executive summary or abstract.

A descriptive abstract tells the reader

a what the report is about
b the purpose
c methods used
d the scope.

An informative abstract also includes

e the results
f conclusions
g recommendations.

Look at the informative abstract in A. Match each of the points a–g above with phrases in the abstract.

EXAMPLE

A *the most effective way to reduce the costs of heating an average home in Britain and reduce carbon emissions*

4 Use the notes in B to write part of a report on two possible bridge designs. Write the title, list of contents, introduction, summary, and conclusion for the report. Use expressions from *Clipboard*.

Clipboard

Language for reports

Introduction

The aim of this report is to ...
The purpose of this report is to ...
This report presents ...
In this report we review ...

Recommendations and conclusions

In conclusion,
... A is recommended as it ...
We recommend ...
Based on the research, we recommend that ...
The main recommendations are

A

This report compares fourteen different practical measures that can be taken in order to find the most effective way to reduce the costs of heating an average home in Britain and reduce carbon emissions. To achieve this, the research compares the cost of installation, the number of years required to pay back the investment cost and the amount of carbon saved each year. The study shows that the cost of insulating loft and walls is recovered within three years but saves only a small amount of carbon. Although it takes approximately thirteen years to pay back the cost of installing a ground source heat pump, it saves the maximum amount of carbon and is, therefore, the best long-term solution. Based on the research, we recommend that, where possible, new homes are fitted with ground source heat pumps.

B

Two possible bridge designs
steel beam bridge and composite girder bridge

Background:	*Dual carriageway – total 4 lanes to cross river Dee, north Scotland* *Span 132 metres between man-made compacted fill embankments* *Soil conditions uncertain* *16 metres above water level* *Gradient – 0.07m/m*
Criteria:	*Method of construction* *Costs of construction and maintenance* *Aesthetics* *Durability*
Include:	*Sketches of elevations and cross-sections* *Costing calculations* *Time scale*
Comparison:	*Both bridges need piers on piled foundations due to soil.* *Design 2 made of steel so longer spans but we recommend design 1*
Recommend:	*Design 1 – minimal framework in construction* *Easy to erect* *Cheaper* *More durable*

Writing bank key

Emails

1 1 T – Although it is still polite to include a simple greeting such as *Hi*, and end with *Best wishes* or *Regards*.

2 F – Emoticons should not be used in business emails because they are not considered serious and, in fact, sometimes rude.

3 F – People consider this to be rude. Write a word in italics if you really need to highlight it.

4 T – Emails are used for quick communication, not for long speeches, and should be brief and to the point.

5 F – It is rude not to reply promptly. If you cannot give a definitive answer, acknowledge receipt of the email and promise to get back as soon as possible.

6 T – Other people can read the recipient's emails and the recipient may forward the email to others.

7 F – Because you cannot see the recipient, he / she has no way of understanding that you are joking and may misunderstand a joke.

2 1 Health and Safety Officer in a woodworking company

2 Employee of a company manufacturing earplugs

3 Technical details of the revolutionary earplug

4 So that he realizes the company need for such earplugs: they are required for industrial use, not retail.

3 a 5 e 1
b 7 f 3
c 2 g 4
d 6

4 1 By referring to the telephone conversation earlier

2 I would be grateful / Can you

3 Dear Ken; Dear Sir / Madam. Per knows the person he is writing to.

Describing graphs

1 Fig. 1 The temperature increased / went up slowly / gradually.

Fig. 2 There was a sharp / steep increase / growth in solar energy production.

Fig. 3 Rice production dropped / decreased moderately / considerably.

2 1 The amount of energy from different sources that was used between 1950 and 2005.

2 Years 1950 to 2005

3 Energy in Joules.

4 Petroleum, natural gas, and coal. Petroleum reached a peak in 1978 but fell dramatically until 1983. There was very little energy from alternative sources. Nuclear electric power grew significantly after 1970.

3 1 It describes what the graph is about using information from the title, the X, and the Y axis

2 It gives an overview of the trends shown in the graph.

3 Just over; roughly; about

4 1 They compare different modes of transport for passengers and cargo in Croatia.

2 In the same order as

3 But, however

5 line graph, line graph
pie chart, pie chart

CV

1 1 Polam Hall School, Darlington

2 Business Studies, General Studies, Chemistry, Mathematics, Biology

3 University of Leeds

4 Environmental biogeoscience

5 Worked with the Worldwide Fund for Nature, species and habitat management

6 Cornwall, England

7 Sold tickets, guided people, helped with activities for children

8 Highly motivated and hard working, good team worker, excellent communication and organizational skills, enjoys encouraging and motivating others

9 He travels, plays the piano, and sings.

Memos

1 1 To inform employees in the Maintenance Department about apprenticeships in September and to ask team leaders to attend a meeting to discuss matters relating to this.

2 There will be interviews.

3 Attend a meeting in room D on Thursday 17 May at 9 a.m

2 1 d 3 a 5 b
2 f 4 e 6 c

Instructions

1 A Stop D Lower
B Move forward E Raise
C Move backwards

2 B Do not smoke or light a fire.
C Do not walk/cross here.
D Do not use water to put out the fire.
E Do not eat in here.
F Do not drink the water.
G Do not use vehicles.
H Do not touch.

3 1 fight 7 Aim
2 Call 8 Hold
3 Choose 9 Squeeze
4 Pull out 10 Be
5 Point 11 Sweep
6 Release

Health and safety

1 1 Abdul Azizi

2 9

3 Broken leg and bruised arms

4 Perhaps he couldn't see because of something in his line of view. Or perhaps, because he didn't expect anyone to be near his truck, he wasn't looking carefully. A nine-year-old boy, who was not wearing any safety site clothing, would be very difficult to see.

3 6.0 Findings
6.1 D
6.2 B
7.0 Recommendations
7.1 C
7.2 A

Reports

1 1 describes 4 issue
2 purpose 5 possible
3 written

2 a 7 e 1
b 5 f 6
c 2 g 3
d 4

3 b *... to find the most effective way ...*

c *... the research compares the cost of installation, the number of years required to pay back the investment cost, and the amount of carbon saved each year.*

d *This report compares fourteen different practical measures ...*

e *The study shows that the cost of insulating loft and walls is recovered within three years but saves only a small amount of carbon. Although it takes approximately thirteen years to pay back the cost of installing a ground source heat pump, it saves the maximum amount of carbon and is, therefore, the best long-term solution.*

f *... a ground source heat pump ... is the best long-term solution.*

g *... new homes* (should be) *fitted with ground source heat pumps.*

9 Petroleum engineering

Switch on

1 Which of these products is **not** derived from oil?



2 What other oil-derived products can you list?

WORK EXPERIENCE	
Dates	1997-98
Employer	BP
Position held	______ 1
Dates	1998 2000
Employer	BP
Position held	______ 2
Dates	2001-2004
Employer	BP
Position held	Assistant Driller
Dates	2004 to present
Employer	______ 3
Position held	______ 4
QUALIFICATIONS	
Montrose College	______ 5
Aberdeen Drilling School	Diploma in ______ 6

It's my job

1 List these jobs in order of seniority.

Roustabout ______

Assistant Driller ______

Driller ______

Roughneck ______

Drilling Superintendent ______



Now listen to an interview with Michael Lennon, a Driller, to check your answers.

2 Study the extract from Michael's CV. Listen to the interview again and fill the gaps

3 Now listen to the interview again. Answer the questions about Michael. Use information from the interview and your own knowledge.

1 Why did he get his first job on an oil rig?
2 Why is food so important on an oil rig?
3 Why is being a Roughneck considered skilled work?
4 Why did his safety course include learning how to escape from a helicopter?
5 Why do oil-rig workers learn to fish?
6 Why is he hoping to get a shore-based job?

Reading

A rotary derrick

1 Read this description of a drilling rig and label these components on the diagram.

bit	kelly	swivel
crown block	mud pumps	travelling block
drill string	power plant	turntable

Rotary derrick

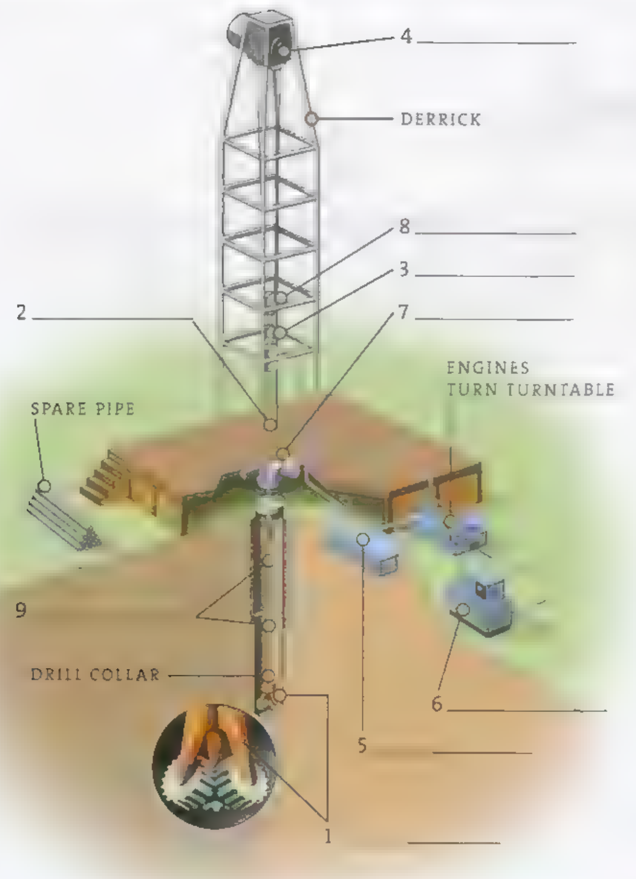
The diagram shows a rotary derrick (a type of tower). The derrick has to be high enough so that sections of pipe can be added or removed. Each pipe section is 10 to 15m long and, as a group, they are joined together to form the drill string.

At the top of the derrick is the crown block, and at the side is the power plant, usually a large diesel engine. The power plant provides power for the draw works, which are used to lift sections of pipe in and out of the borehole. It also powers the mud pumps. The mud is used for lubricating the bit, as well as the turntable.

The travelling block is suspended by a cable from the crown block and can move up and down. The swivel is

In this unit

- transferring information from a text to a diagram
- Present tense review
- short forms of *be* with the Present Continuous in connected speech
- speaking about oil refining



attached to the travelling block (a swivel is something which is free to rotate). The swivel allows the pipe to rotate freely. The travelling block raises or lowers the pipe. The kelly is a heavy pipe approximately 13m long. It is square or hexagonal in section and is suspended from the swivel. It fits through the slot in the turntable and connects to the top joint of the drill string.

The rotary derrick works as follows. First, the power plant turns the turntable. Then, as the turntable rotates, it turns the kelly, which rotates the drill string. At the end of the string of drill pipes is the diamond-toothed bit. As the pipe turns, the bit cuts the borehole.

2 Read the text again. This time note the functions of these rig components.

Component	Function
bit	cuts the borehole
draw works	
kelly	
mud pumps	
power plant	
swivel	
travelling block	

3 Work in pairs. Ask and answer questions about the function of the different components.

EXAMPLES

A What does the bit do?
B It cuts the borehole.

Vocabulary

Collocations in petroleum technology

1 Make common collocations related to oil by matching nouns in **A** with nouns in **B**.

A	B
drill	fuel
aviation	string
power	driller
fossil	pump
mud	fuel
assistant	plant

2 Now use the collocations in **1** to complete the sentences.

1 The ______________ provides the lubricant.
2 The bit is located at the end of the ______________
3 An ______________ needs qualifications to do the job.
4 Oil and coal are types of ______________
5 The ______________ is run on diesel.
6 ______________ is used in planes.

Some estimates calculate that up to 25% of the world's undiscovered oil reserves could lie beneath the Arctic Ocean.

Language spot

Present tense review

- Study this diagram:

They're having a lunch break now.

PAST PRESENT FUTURE

2004 2005 2006 2007 2008 2009 2010 2011

They paint the rig every year

- Both the Present Simple and the Present Continuous describe the present, but the Present Simple can include the past and the future – it describes things which are always true or routine. The Present Continuous has a more limited range.
- Study these examples:

*I **like** the work.*
*It's **pouring** with rain.*
*Roustabouts usually **get** jobs like painting.*
*Venezuelan oil **contains** a lot of sulphur*
*I'm **working** on the rig this month.*
*I **own** a 500cc Yamaha motorbike.*

1 Mark with PS or PC which tense is used with

1 non-action verbs ______
2 temporary or unusual activities ______
3 verbs of thinking or feeling ______
4 facts ______
5 things happening right now ______
6 adverbs of frequency ______

- Sometimes the choice of tense depends on the speaker's point of view. The tense we use can reflect how far we think of an action continuing beyond the present. Note how Michael says:

*I'm **hoping** to get a shore-based job.* (I expect this will happen quite soon.)

Contrast this with:
*I **hope** to get a shore-based job.* (At some point in my career.)

Compare:
*I'm **working** on a rig.* (I don't plan to work there for much longer.)
*I **work** on a rig.* (This is my job for some time to come.)

2 Put the verbs in brackets in the best form. Use the speaker's point of view in *italics* to help you.

1 I ______ (live) in the USA. (*This is my home.*)
2 I ______ (live) in Texas. (*I don't think of this as permanent.*)
3 I ______ (study) English. (*Next year it will be Spanish.*)
4 I ______ (study) music. (*I don't think I'll ever give it up.*)
5 I ______ (play) football for the local team this season. (*I don't think this will go on for another season.*)
6 I ______ (play) football. (*It's a hobby.*)

- Some non-action verbs normally used to describe states can sometimes be used with the Present Continuous. Study the examples:

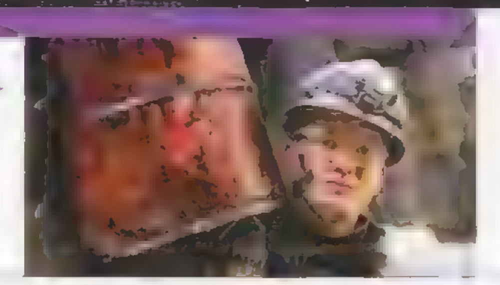
*Crude oil **feels** sticky.*
*I'm **feeling** sick. It's the smell of oil.*

» Go to **Grammar reference** p.118

3 Circle the correct form.

1 Don't forget. *I'm seeing / I see you* at ten tomorrow.
2 *I see / I'm seeing* the weather has improved.
3 *I'm thinking / I think* of buying a hybrid car.
4 *What do you think / What are you thinking* of hybrids?
5 *I hear / I'm hearing* more and more complaints about this product.
6 *I hear / I'm hearing* very little with my left ear. It's been like that since the accident.

A 42-US-gallon barrel of crude oil produces 44 gallons of petroleum products



Pronunciation

be with the Present Continuous

Because the different parts of the verb *be* are usually contracted in the Present Continuous, it is easy to miss out *be* when using this tense.

1 Each of these phrases has a short form of *be*. Listen and repeat them.

1. I'm looking for my goggles.
2. You're standing too close.
3. He's not wearing a helmet.
4. We're having a fire drill.
5. They're learning first aid.

2 Complete the sentences with the correct contracted form of the verb *be*.

1. We ______ studying to be Petroleum Engineers.
2. She ______ taking a safety course.
3. I ______ working for a Dutch company at the moment.
4. They ______ planning to shut down the well.
5. You ______ not following the instructions properly.
6. Who ______ looking after this site?

3 Now listen to the sentences and check your answers. Repeat them.

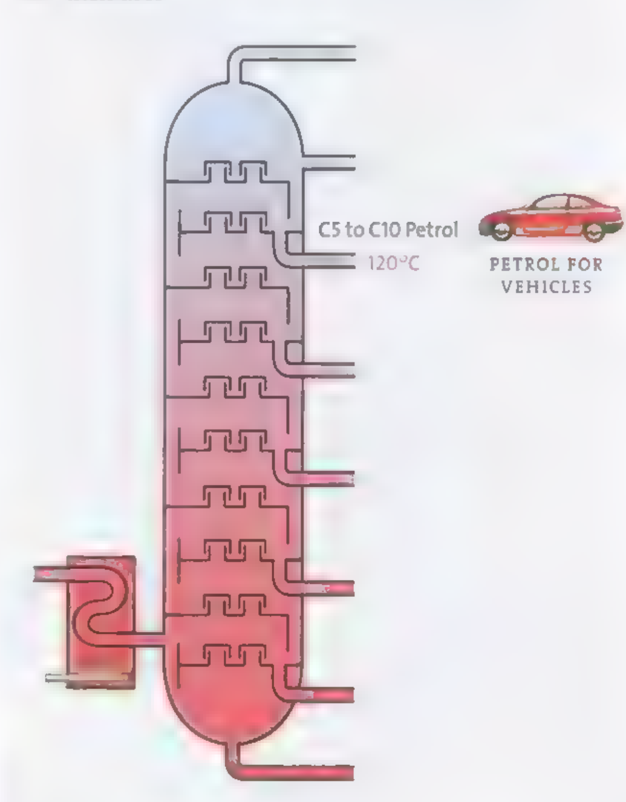
Pairwork

1 Read this introduction to oil refining.

Crude oil consists of many different hydrocarbons mixed together. Hydrocarbons contain hydrogen and carbon in different combinations. To convert crude oil into useful products, it has to be refined. The first process in refining is fractional distillation, which separates lighter constituents (fractions) from heavier ones. This is done by heating the oil. The vapour enters a distillation column. Each fraction condenses at a different point in the column, and so can be separated out. Fractions with high boiling points condense in the lower part of the column. Fractions with low boiling points condense at cooler temperatures further up the column.

2 Work in pairs, A and B. Each of you has a diagram of a distillation column like the one below, which contains some information about:

- the names of the constituents (the fractions)
- the temperature at which different hydrocarbons vaporize
- the products
- their uses



Ask and answer questions to find the information missing from your diagram.

EXAMPLES

At what temperature does gasoline condense?
Which hydrocarbon vaporizes at 40°C?
What is gasoline used for?

Student A Go to p.113.

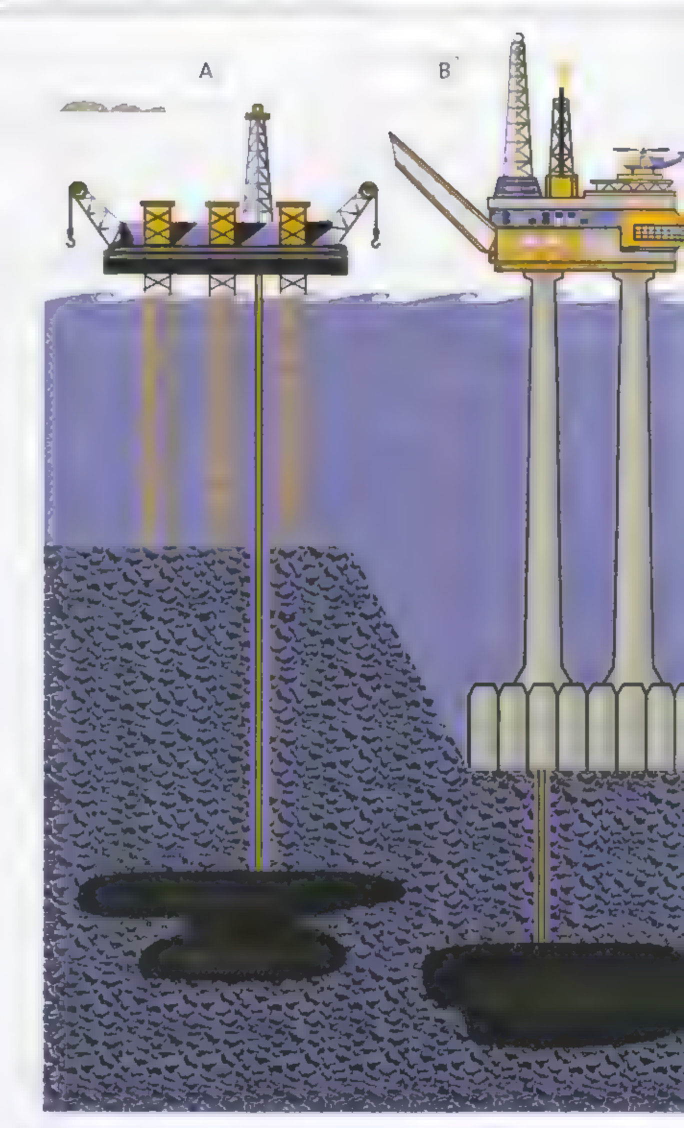
Student B Go to p.111.

car jack (n) piece of equipment used to lift a car in order to change a tyre

Problem-solving

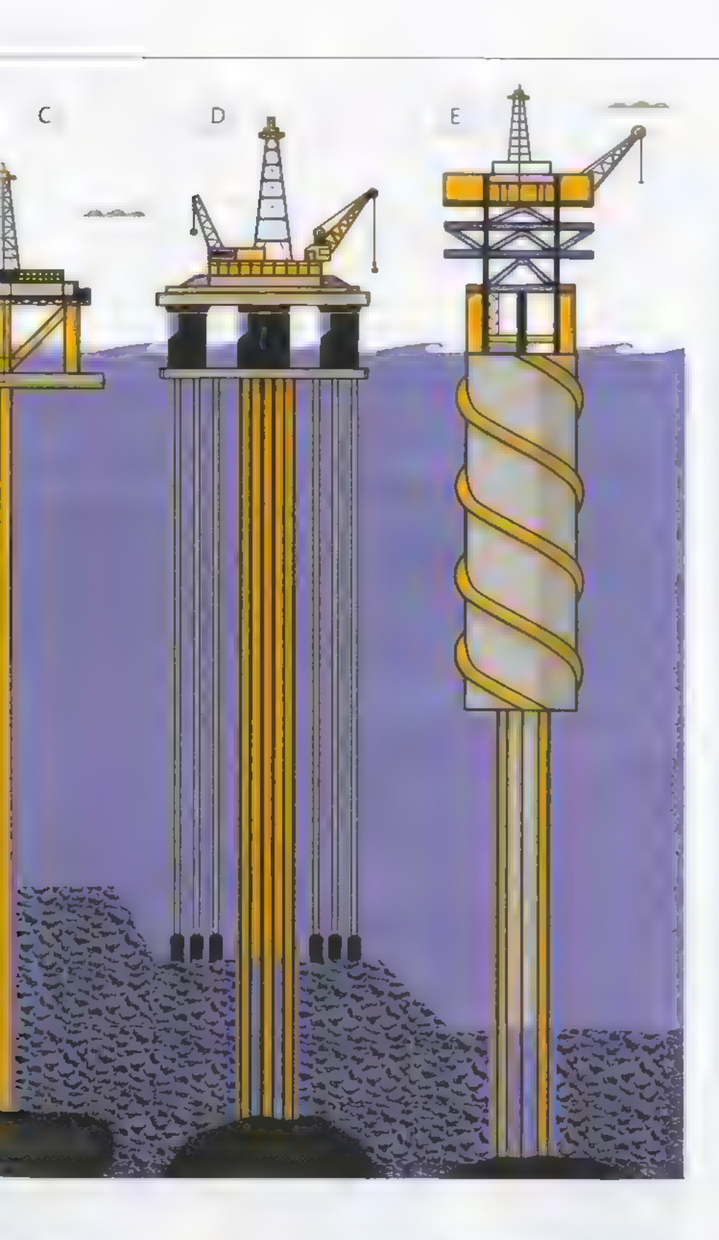
1 In small groups, match these descriptions of oil platforms to the correct illustration. Be prepared to justify your answers.

1 gravity or fixed	Gravity or fixed platforms sit on the seabed Often have a concrete base with three to four hollow columns acting as legs with a steel deck built on top. Used in water up to 520m. Gravity rigs are often built in sheltered waters, then floated out to sea and sunk in position. The hollow legs and base can be used for storing oil They cannot easily be moved when their useful life is over, so disposal can be a problem
2 jack-up	These platforms sit on steel legs. The legs can be lowered to raise the platform above the sea (like a **car jack**). They are used in shallow waters up to about 100m. They are cheap, and are reusable, as they can be moved to other locations. However, there are towing problems with these rigs and their safety record is poorer than other types.
3 semi-submersible	Stands on columns which sit on pontoons below the level of the sea. These provide enough lift to float the platform and enough weight to keep it upright. By altering the amount of water in the pontoons, the platform can be moved up and down. They are used in water of 600–1800m in depth. They are very stable, even in rough seas. They can be easily moved to new locations. They need more support vessels because they have limited storage.
4 spar	Spars are floating platforms moored to the seabed. They come in three forms: a *cell spar* has a body composed of a number of vertical columns, a *conventional spar* has one column, and a *truss spar* has a floating hard tank at the top linked to a soft tank at the bottom, which is weighted to provide stability to the structure. Spars are cheaper and more stable than tension leg platforms. They are suitable for depths up to 1800m. They can be moved horizontally.
5 tension leg	These are floating platforms where the mooring system prevents vertical movement. This means that the well can be tapped directly from the platform. They can be used in depths of 200–1100m. They are inexpensive to make compared with other platform types, and can be moved to new locations, but are less stable than fixed platforms.



2 Complete the table for each type of platform described above.

Type	Depth of water



Advantages	Disadvantages

Checklist

Assess your progress in this unit. Tick (✓) the statements which are true.

- I can transfer information from a technical text to a diagram
- I know the differences in use between the Present Simple and the Present Continuous
- I know how to pronounce short forms of *be* in connected speech
- I can speak about oil refining
- My reading and listening are good enough to understand most of each text in this unit

Key words

Adjectives
qualified
shore-based

Nouns
bit
constituent
drill
hydrocarbon
platform
rig
seabed

Verbs
attach to
deal with
lower
lubricate
raise
refine

Note here anything about how English is used in technology that is **new** to you.

10 Environmental engineering

Switch on

1 Make a list of what causes environmental pollution. Look at the pictures for some ideas.

2 Environmental technology tries to reduce and overcome the effects of pollution. Match the topics 1–7 with the pictures A–G.

1 Water purification
2 Solid waste management
3 Recycling
4 Remediation
5 Renewable energy
6 Flue gas treatment
7 Sewage treatment



In this unit

- reporting what someone said
- how to recognize and show disbelief
- discussing sustainability
- using information from listening to complete a diagram about water treatment

Language spot

Reported speech

- When we report what someone has said, we have to make several changes to the original words. Study the examples and notice what happens to:
- The tense
- Time expressions, e.g. *next week*
- Pronouns, e.g. *we*

'You'll have to change the filters next week,' said Mr Bran.
Mr Bran said we would have to change the filters the following week.
'I usually check the pipes for cracks once a month,' the Inspector explained.
The Inspector explained that he usually checked the pipes for cracks once a month.
'After the heavy rain yesterday the drains overflowed,' the Engineer said.
The Engineer said that after the heavy rain the previous day, the drains had overflowed.

1 Complete the rules.

Verb tense

Present Continuous → *Past Continuous*

Present Simple → ________ 1

Past Simple → ________ 2

Present Perfect → ________ 3

will → *would*

can → ________ 4

must → ________ 5

Time expressions

today → *that day*

yesterday → ________ 6

this week → ________ 7

next month → ________ 8

» Go to **Grammar reference** p.119

2 Report what the following people said.

1 'We will improve efficiency,' explained the Engineer.

2 'Jon has tested yesterday's samples,' said the Supervisor.

3 'You will be fined if you pollute the river,' warned the Inspector.

4 'Our design team has won this year's prize for innovative technology,' announced the Director.

- When a question begins with *who*, *which*, *what*, etc., we use that question word when we report the question.

- For *yes/no* questions we make sentences with *if* or *whether*.

- The word order in the reported question is the same as for a statement, not a question. We change the tense of the verb as in **1**.

'How do you dispose of the waste paint?'
The Inspector asked how we disposed of the waste paint.
*'**Do you add** chlorine to the water?'*
*The Engineer asked **if we added** chlorine to the water.*
*'**Will you be able to repair** the sewage pipe today?'*
*The Foreman asked **whether we would be able to repair** the sewage pipe that day.*

3 Read the report. Then complete the dialogue.

I asked the engineer how he applied paint to the products. He explained they sprayed the paint in a ventilated closed room. When I asked him how much of the paint actually reached the product he said they estimated about 40%. He explained that the excess was removed in the air stream and paint particles were absorbed in a water curtain. I asked if this was stored. He said this settled in a tank and the resulting sludge had to be disposed of.

Interviewer	How ________ 1 paint to the product?
Engineer	We ________ 2 in a ventilated, closed room.
Interviewer	How much of the paint ________ 3 the product?
Engineer	The excess ________ 4 in the air stream and paint particles ________ 5 in a water curtain.
Interviewer	________ 6?
Engineer	This ________ 7 in a tank and the resulting sludge ________.

Vocabulary

Reporting verbs

1 Listen to the telephone call and complete the notes in the email.

Hi Jon

I've spoken to Lila. She confirmed that the pipe from the ________________[1] had become partially blocked and agreed to ________________[2] quickly. She apologized for not finishing the ________________[3] on the proposal and promised to let me have it ________________[4].

2 When we report what has been said in a conversation, we often paraphrase (explain more simply). We use reporting verbs to do this. Look at the underlined verbs in the email and listen again, or read the *Listening script* on p.127.

Reporting verbs

admit	confirm	question
advise	enquire	recommend
agree	insist	remind
apologize	offer	suggest
ask	promise	thank
complain	propose	

3 Complete sentences a–h with the correct form of reporting verbs in 2.

a Yana ________________ Freya to close off the valve.

b The Manager ________________ for the delay and ________________ them for their patience

c The Engineer ________________ the results from the survey.

d His boss ________________ him to check the water pressure.

e The Engineer ________________ to change the pressure

f The Engineer ________________ to meet the Manager at the plant

g The Manager ________________ about the standard of work.

h The Consultant ________________ keeping building to a minimum.

Freya, could you close off the valve, please?

Yes, that's a good idea. We'll change the pressure.

I'm really very sorry that you've had to wait so long for the spare parts and I'm very grateful to you for being so patient.

Would it help if I met you at the plant so we could discuss the problem together?

I'm not sure I can believe these results. Are you sure the survey was carried out correctly?

The maintenance of this equipment has not been done properly. There are leaks which still haven't been fixed.

Please don't forget to check the water pressure in the pipes.

I feel that in order to safeguard wildlife in the area, building will have to be kept to a minimum.

Pronunciation

Showing disbelief

1 Listen to the two dialogues. Which speaker, B or D, does not believe what Calum said?

How does the stress and intonation show this?

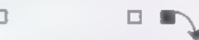
A *How much water will it save?*

B *Calum said it would save 30%.*

C *How much water will it save?*

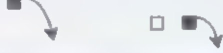
D *Calum said it would save 30%.*

Notice the stress and intonation. In normal reported speech, the intonation is like this:



Calum said it would save 30%.

but to show disbelief there is a heavier stress on *said*, and the intonation goes down like this:



Calum said it would save 30%.

habitat (n) The place where a particular animal or plant is found
ecology (n) the relation of plants and living creatures to each other and to their environment

sustainable (adj) involving the use of natural products and energy in a way that does not harm the environment: *sustainable development*

2 Look at these six things that people have told you recently. Tick (✓) three that you believe and cross (✗) three you do not believe.

a The article said that the Japanese could convert waste plastic film into biodiesel. ☐
b Scientists said that the world temperature would increase by 5°C in 50 years. ☐
c The Engineer told us he had found a cheap way to remove oil pollution from beaches. ☐
d The reporter said that each passenger flying from London to New York produced 1.28 tonnes of carbon. ☐
e The report said that ships produced less pollution than aircraft. ☐
f The politician told us that the government would provide more money for research into sustainable technology. ☐

3 Work in pairs, A and B. Take turns telling each other about the things in **2**. Can your partner work out what you believed and what you didn't from your intonation?

It's my job

1 What is an Environmental Engineer's job like? Work with a partner and discuss the following questions.

1 Does the job require a university degree?
2 Does the job involve travel?
3 Do you have to speak other languages?
4 Is it an office-based job?
5 Is there a lot of written communication?
6 Why does someone choose to work in this field?

2 Now read about Lutz and answer the questions in **1**.

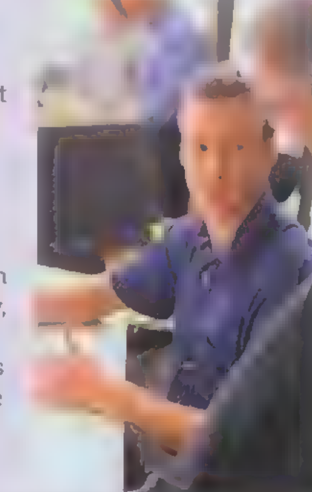
3 Answer the questions.

1 What aspects of the environment does Lutz work with?
2 Who does he work for?
3 What does he especially enjoy about his job?
4 Would you like to do this job? Why?

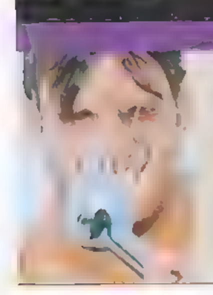
Lutz Werner: Environmental Engineer

While studying Civil engineering at university, I became increasingly interested in water, in particular water supply. So, I went back to university and did a post-graduate qualification in Environmental studies. Today I work in the Environment Department of a large engineering company. I'm responsible for environmental assessments, strategic assessments, contamination assessments, and waste management.

Nowadays, I'm mainly office-based. In a typical day I review proposals for new works, for example building an airport in the Far East, designing a solid waste management plant, or carrying out an environmental assessment proposal for a resort development in the Caribbean. I have to look at the environmental impacts, the scale and design of a project, and the pricing. Civil Engineers, Geologists, Ecologists, Environmental Scientists, and Landscape Architects are some of the specialists involved. The effects a project will have on **habitats** and the **ecology** of the area are really important, and we also have to think about sustainability. This includes looking at the effects a project will have on the people who live locally, both during construction and after the project is completed. I regularly review on-going projects with the Project Managers.



I like my job because I'm very interested in the subject. It gives me a great sense of satisfaction to feel I can make a difference. When we're designing engineering facilities, there's a real sense of excitement when the plans turn into reality, especially with something innovative. It's great to work with people who all share a desire to see **sustainable** development.



Gadget box

Researchers at the Commonwealth Scientific and Industrial Research Organisation have developed a device that reduces the amount of water used when showering by 30%. When the Aerated Showerhead is fitted, it creates a vacuum that sucks in air and forces it into the water stream. Researchers say that people don't notice any difference when taking a shower.

How significant is such a device in terms of the environment?

Pairwork

1 How can a fully-sustainable eco-city work? Work in pairs, A and B. Discuss ways this could be achieved using these headings.

Public transport	Food supplies	Buildings
Water supply	Waste	Energy

EXAMPLE

Buildings

I think that materials for the buildings would have to be found locally. That way there would be little transport needed. And buildings would have to be well insulated to reduce the amount of energy needed to heat or cool them. If buildings had big windows, you could use sunlight instead of electric lights.

2 Dongtan is an example of a fully-sustainable eco-city that is being developed in China at the moment. Work in pairs, A and B. Read your text and make notes. Ask and answer questions to complete the table

Student A Go to p.113.

Student B

Chongming Island lies in the Yangtse River Delta in China. It is the world's largest alluvial island, which has been formed by deposits of soil carried down the river. This island is the site of the town of Don'tan. With a projected population of 50,000 in 2010, Dongtan is the first sustainable eco-city.

On the southern part of the island there is a large wetland area famous as a bird reserve for rare species. This is a major tourist attraction, providing employment and income. The surrounding area is fertile agricultural land where food for the city is grown. Nearby fishing communities supply the city with fish. The city is self-sufficient in fresh water, which is recycled. Devices capture rain water from buildings and channel it into canals and water features. There are no landfill sites because waste is recycled. Organic waste is composted and then returned to local farmland to fertilize the soil. Sewage is also returned to the fields after treatment. The population of the city is expected to reach 500,000 by 2030.

Transport

Food supply

Building construction

Water supply

Waste

Energy

3 Discuss the questions with your partner. Use your own knowledge.

1 Why does the area have fertile agricultural land?
2 What are the advantages of creating an eco-city on an island?
3 What are the advantages and disadvantages of having a bird reserve on the island?
4 Is it possible to dispose of all waste without a landfill site?
5 Why are the wind turbines located outside the city?
6 Why have they chosen to use biomass?

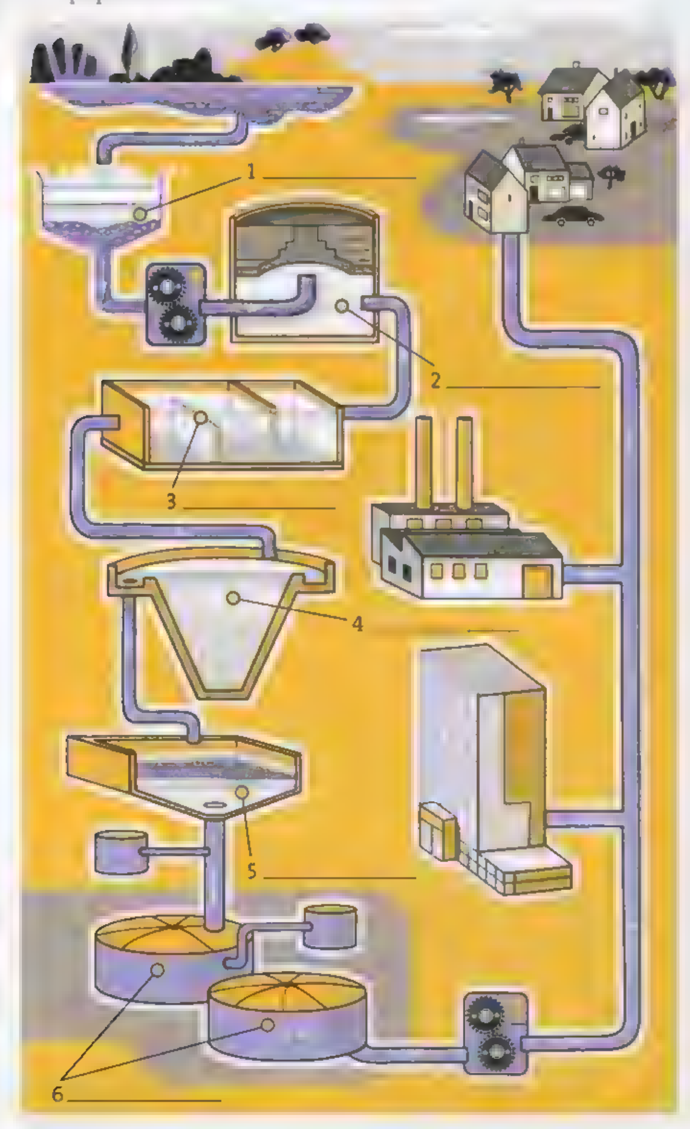


Listening

Cleaning water

1 🎧 Listen to a lecturer talking about water and label the equipment 1–6 in the diagram.

2 🎧 Listen again and make notes about what the equipment does.



3 Find out about the supply of fresh water in your area. Where does it come from? How is it treated?

Checklist

Assess your progress in this unit. Tick (✓) the statements which are true.

- I know how to report what someone said
- I know key verbs used to report what someone has said
- I can recognize when someone is showing disbelief
- I can transfer information from listening to complete diagrams
- My reading and listening are good enough to understand most of each text in this unit

Key words

Nouns
contamination
environmental impact
filtration
flue gas treatment
impurities
remediation
reservoir
sewage
waste
water purification

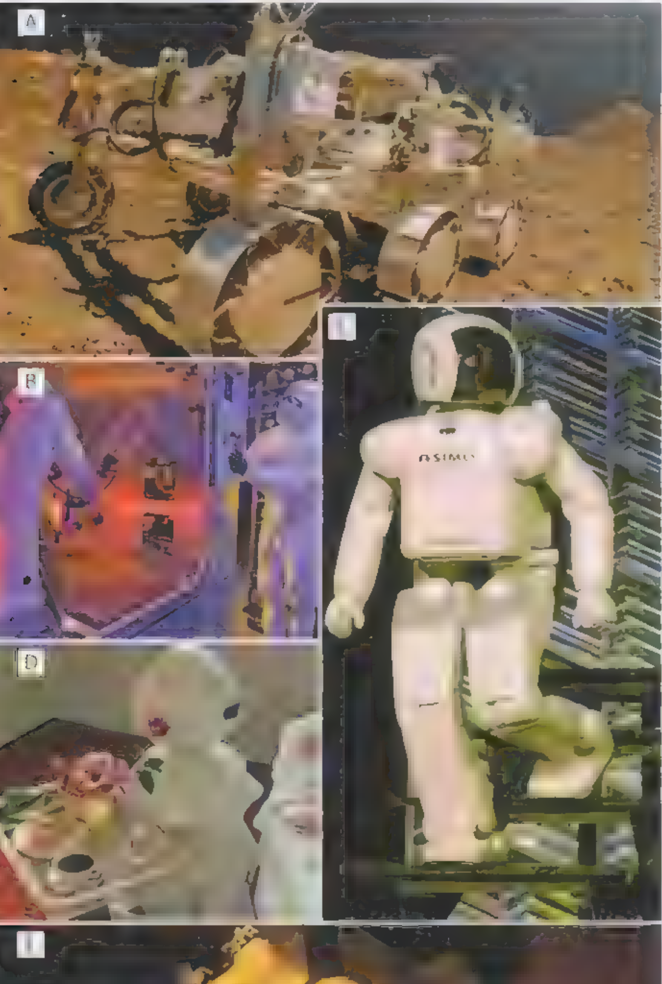
Verbs
apologize
confirm
recommend
remind
suggest

Note here anything about how English is used in technology that is **new** to you.

11 Robotics

Switch on

Work in small groups. What could these robots be used for? Compare answers with others in your group and provide reasons to support your answers.





Reading

How robots work

1 Study the opening sentences for each paragraph in this textbook extract. Predict the topics of each paragraph.

First sentence	Possible topics
1 Robots have five basic components: a movable structure, a motor, a power source, a sensory system, and a processor.	
2 The motor provides the physical power to move the structure.	
3 In the same way that humans depend on sight, hearing, taste, smell, and touch to make sense of the world, robots require a sensory system in order to function.	
4 Heat sensors may be important for robots working in extreme conditions	
5 The brain of a robot is the processor.	

2 Try to answer these questions before you read. Compare answers with others in your group.

1 In what ways can robots move?
2 What kinds of motor can robots have?
3 What kinds of power source can robots have?
4 What does the sensory system do?
5 What does the processor do?

3 Now read the text to check your predictions in **1** and your answers in **2**.





In this unit

- predicting text content by sampling key sentences
- listening and note-taking
- ways to describe causing, preventing, and enabling links
- how to improve your presentation skills
- sharing ideas on how to solve a problem

Robots – moving, powering, feeling, and thinking

Robots have five basic components: a movable structure, a motor, a power source, a sensory system, and a processor. The entire robot may move, on legs in the case of Honda's Asimo, on wheels, or on caterpillar tracks in the case of Urbie, or only one part may move, such as the arm of an industrial robot.

The motor provides the physical power to move the structure. It may be electric, pneumatic, or some form of heat engine. All motors require a source of power. In the case of mobile robots, the usual source is a battery. The problem with batteries is that they are heavy and run down quite quickly. In future there may be robots which use biological fuel which they collect as they move. Compressed air, in tanks for mobile robots or directly from a compressor for fixed robots, is the power source for pneumatic systems.

In the same way that humans depend on sight, hearing, taste, smell, and touch to make sense of the world, robots require a sensory system in order to function. Sensors feed information to the processor. The information provided depends on the function of the robot. Location is important for most robots. Industrial robots must be capable of placing items or performing actions in exactly the right place. With some robots, location is controlled by placing electronic tracks for the robot to follow. Container handling in ports can be done by robotic vehicles following such tracks.

Heat sensors may be important for robots working in extreme conditions. Sensors which measure the pressure exerted by robot arms or pincers are important for robots which pick up or handle delicate items. For robots which walk or climb stairs, information on weight distribution and balance is important. Robots which look for some types of explosive need sensors which can detect chemical smells. Robots which have to navigate over unfamiliar ground, such as the Mars Rover, have digital cameras to help them identify obstacles and select navigable routes.

The brain of a robot is the processor. It controls the operation of the robot. It is programmed to allow the robot to carry out a series of actions and to respond to feedback from the sensory system. In the case of a simple robot, such as a domestic vacuum cleaner, the program may instruct the robot to turn 90 degrees when it collides with an obstacle.

Problem-solving

1 Robotic vacuum cleaners which can clean floor surfaces by themselves are becoming more common. Work with a partner to list the kinds of sensors they need.

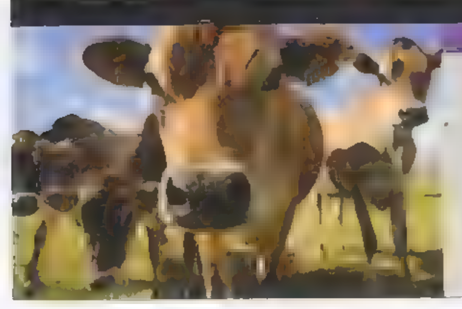
2 Listen to this short talk by a Sales Rep at a trade fair about how a robotic vacuum cleaner works. Note down information about one of the types of sensor it uses. Your teacher will advise you which type to listen for. Note what the sensors detect and how they do this.



3 Now exchange information with others in your class to complete the table.

4 Listen again and check your answers.

Sensors	Notes
dimension sensors	
object sensors	
cliff sensors	
wall sensors	
dirt sensors	



Gadget box

The DeLaval Voluntary Milking System can milk 60 cows three times a day. Cows decide when they wish to be milked. The robot checks if the cow is ready, milks the cow, compares its production with previous yields, and cleans itself before the next cow enters.

What would be the main advantage for dairy farmers?

Language spot

Causing, preventing, and enabling links: *cause to, make, prevent, stop, allow to, enable to, let*

- In technology we often have to describe the relationship between actions. Study these pairs of actions about robots. What is the relationship between each pair?

1 a *The object sensor detects an obstacle.*
  b *The robot changes direction.*
2 a *The cliff sensor reports a sudden drop ahead.*
  b *The robot does not move in that direction.*
3 a *Caterpillar tracks are fitted to the robot.*
  b *It can move quickly on rough surfaces.*

In pair 1, one action *causes* another action. In pair 2, one action *prevents* another action. In pair 3, one action *enables* another action.

- Note how we can link each pair to show the relationship between them.

1 *The object sensor detects an obstacle, which* **causes** *the robot* **to** *change direction.*
  The object sensor detects an obstacle, which **makes** *the robot change direction.*
2 *The cliff sensor reports a sudden drop ahead, which* **prevents** *the robot (from)* **moving** *in that direction.*
  The cliff sensor reports a sudden drop ahead, which **stops** *the robot* **moving** *in that direction.*
3 *Caterpillar tracks are fitted to the robot, which* **allows / enables** *it* **to** *move quickly on rough surfaces.*
  Caterpillar tracks are fitted to the robot, which **lets** *it move quickly on rough surfaces.*

- In the examples, *which* refers to the preceding action. In these cases *which* + the active verb can be replaced by the *-ing* form of the verb. For example:
The cliff sensor reports a sudden drop ahead, **preventing** *the robot (from) moving in that direction.*

>> Go to **Grammar reference** p.120

1 Complete the gaps in this text with the correct form of the appropriate verbs.

allow (to)	enable (to)	make	stop
cause (to)	let	prevent	

Land mines kill 800 people every month and ________[1] people returning to their homes after a conflict is over. Comet III is an experimental mine-clearing robot developed at Chiba University in Japan. It is fitted with caterpillar tracks, ________[2] it move quickly over rough ground. For mine-hunting it has six legs, ________[3] it to walk delicately through mine fields. It takes 20 seconds to calculate each step. Slow processing speeds ________[4] Comet III from moving more quickly, but faster processing chips should ________[5] Comet III to reach human walking speeds in future.

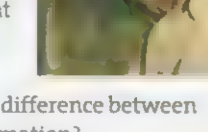
Comet III has stereo vision provided by two digital cameras. This ________[6] it navigate by itself without the help of remote control. Comet III has metal detectors and ground-penetrating radar, ________[7] it to detect different types of mine. A reflected signal from a mine ________[8] Comet III to probe gently to uncover the mine. Vibration or pressure can ________[9] a mine explode, so the work must be done with care.

Sometimes the ground is very hard, which ________[10] the probe uncovering mines. Newer models fitted with drills and an air hose will ________[11] the robot do this safely. A robotic hand will ________[12] the robot to pick up rocks.

2 Decide on the relationship between each of these pairs of actions. Then link them using an appropriate verb.

1. The power sensor reports low battery current to the processor.
   The robot cannot move.
2. The bumper is pressed in.
   The object sensor reports an obstacle to the processor.
3. The sensors detect a 'cliff'.
   The robot reverses.
4. Infrared signals from the robot are reflected by a wall.
   The robot changes direction and moves parallel to the wall.
5. Dirt hits the acoustic impact sensor plates.
   The plates vibrate.
6. The sensors detect the vibration and pass a signal to the processor.
   The robot cleans the area again.

It's my job



1 Before you listen to Jaako Ikonen, Senior Manufacturing Systems Engineer, answer these questions with a partner.

1. What do you think Jaako's responsibility is?
2. One of his products involves biosensors. What do you think a biosensor is?
3. What do you think is the difference between mechanization and automation?

2 Now listen and check your answers.

3 Listen again to find the answers to the questions.

1. What did he study at college?
2. Why did the mobile phone company need to automate?
3. What does a blood glucose monitor do?
4. Why must the process of manufacturing the monitors be automated?

Speaking

Assessing explanations

A good way to prepare for presenting information to others is to practise in small groups first.

1 Work in groups of three, **A**, **B**, and **C**.

Student A Go to p. 110.
Student B Go to p.113.
Student C Read text C below.

2 **a** plays the role of Speaker first, telling the others about their text using only notes to help. **B** plays the role of Reporter, taking notes from **A**'s talk and reporting it briefly. **C** plays the role of Assessor, listening carefully to both talks and judging how accurately **B** has reported. If there is disagreement, you can refer to the texts.

3 Continue until each member of the group has played the part of Speaker, Reporter, and Assessor once.

4 Discuss in your group which parts were the easiest and the most difficult to play, and what would help you to play these parts better.

C

FIRST – For Inspiration and Recognition of Science and Technology – is a US organization founded by Dean Kamen, inventor of the Segway. FIRST has run an annual Robotics Competition since 1992 for teams of high-school students. Teams have six weeks to design and construct a robot to solve a particular task, which differs each year.

Teams usually consist of about 25 students with three or so professional Engineers who volunteer to assist them. They often include subteams who look after different aspects of the design of the robot, such as pneumatics, control systems, mechanics, and electrics.

Each team is supplied with a standard set of components including a remote control receiver and transmitter, a microprocessor and software, motors, sensors, a power pack, and mechanical parts.

More than 1,300 teams from seven countries, although mainly from the US, took part in 2007. FIRST also organizes robotics competitions for younger students.

We should have – in rather cheap machines – human level intelligence in well under fifty years.
Hans Moravec
Research Professor in the Robotics Institute of Carnegie Mellon University, 1990

Webquest

FIRST is not the only robot competition available. Work in small groups to research some others and report back to the class what you have found out. You should get information about what the rules are, where the competition is held, and what type of competition it is. Is it based on a competitive sport, such as football, or is it a race or a challenge?

These sites may help:

www.dcs.shef.ac.uk/~noel/competitions.html

www.ecsel.psu.edu/~avanzato/robots/contests/

http://robots.net/rcfaq.html#LNK077

http://cswww.essex.ac.uk/staff/hhu/competition.html

http://robogames.net/index.php

Make your point

Parts of a presentation

1 Lee Avatar has sent you headings for parts of a presentation and some phrases. Put the phrases under the correct headings.

a I'm going to talk about / tell you about .
b Thank you for your attention.
c We can see that ...
d I'm Tom Huber from Allied Industries and it's a pleasure to be with you today.
e We've looked at X, Y, and Z.
f Let's look now at ...
g It's my view that ..
h Good morning, afternoon, etc. ...
i I'll be happy to answer any questions you may have.
j I've discussed X, Y, and Z.
k It seems clear that
l The purpose of my talk is ...
m I want to turn now to ...

2 Make a short presentation (maximum three minutes) to your class / group on any aspects of robotics. Use the phrases in **1**.



STARTING YOUR PRESENTATION

Greet your audience
________________ 1

Introduce yourself
________________ 2

Say what you're going to do
________________ 3
________________ 4

Move to a new point
________________ 5
________________ 6

ENDING YOUR PRESENTATION

Remind your audience of your main points
________________ 7
________________ 8

Make your conclusion
________________ 9
________________ 10
________________ 11

Thank the audience
________________ 12

Invite questions
________________ 13

Project

1 Work in groups. Imagine that you have entered a competition to design one of these robots:

a a robot helper for old people

b a robot pet animal

c a robot fruit picker

Decide together

1 the actions the robot should be able to perform

2 how it will move from place to place

3 the power source it will use

4 the sensors it will need

5 its approximate size and weight.

You can look for ideas on the Web.

www.bbc.co.uk/science/robots/techlab/sub_selector.shtml

www.seanet.com/~garyteachout/robots.html

2 As a group, present your proposals to the other groups. Give reasons for your decisions. Use the phrases from *Make your point*. Be prepared to answer questions about your proposals.

3 As a class, agree on the best proposals for each type of robot. You can combine proposals from different groups.

Checklist

Assess your progress in this unit. Tick (✓) the statements which are true.

I can predict text content

I can link pairs of actions

I can share ideas on how to solve a problem

My reading and listening are good enough to understand most of each text in this unit

Key words

Adjectives
acoustic
extreme
infrared
movable
navigable

Adverb
parallel to

Nouns
automation
caterpillar tracks
explosive
impact
power source
sensory system

Verbs
exert
navigate
program

Note here anything about how English is used in technology that is new to you.

12 Household technology

Switch on

1 Which of these domestic appliances do you use? How many can you name?







2 Which appliance is being described in the sentences?

1 Heat from inside the appliance is transferred to the outside in a refrigerant that flows through pipes

2 The heat from the flat plate heats the molecules in the fibres of the textile and the weight straightens them. As they cool, they keep their shape

3 Food is heated up by making tiny particles of water in the food vibrate.

4 A thermostat breaks the electric circuit when water reaches boiling point.

5 Dirt is sucked in by a powerful current of air

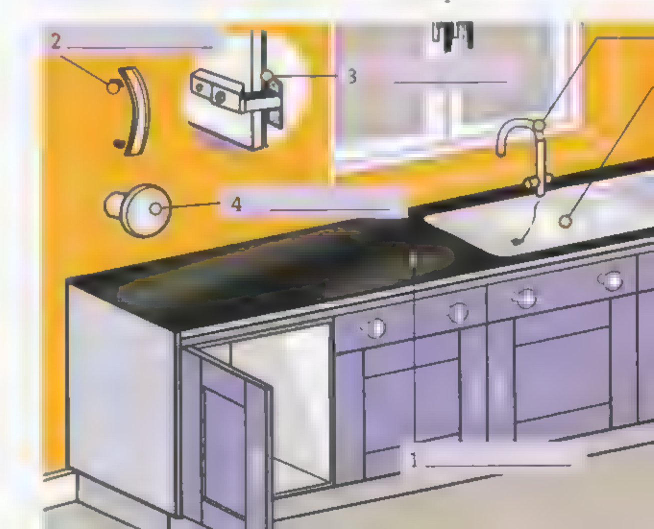
6 The fan produces an airflow which passes through and over the heating element. The flow of hot air speeds up the evaporation of water.

Reading

Making kitchens

1 Work in pairs to label the pictures. Choose from the words below.

drawer	hinge	panel	tap
handle	knob	sink	worktop



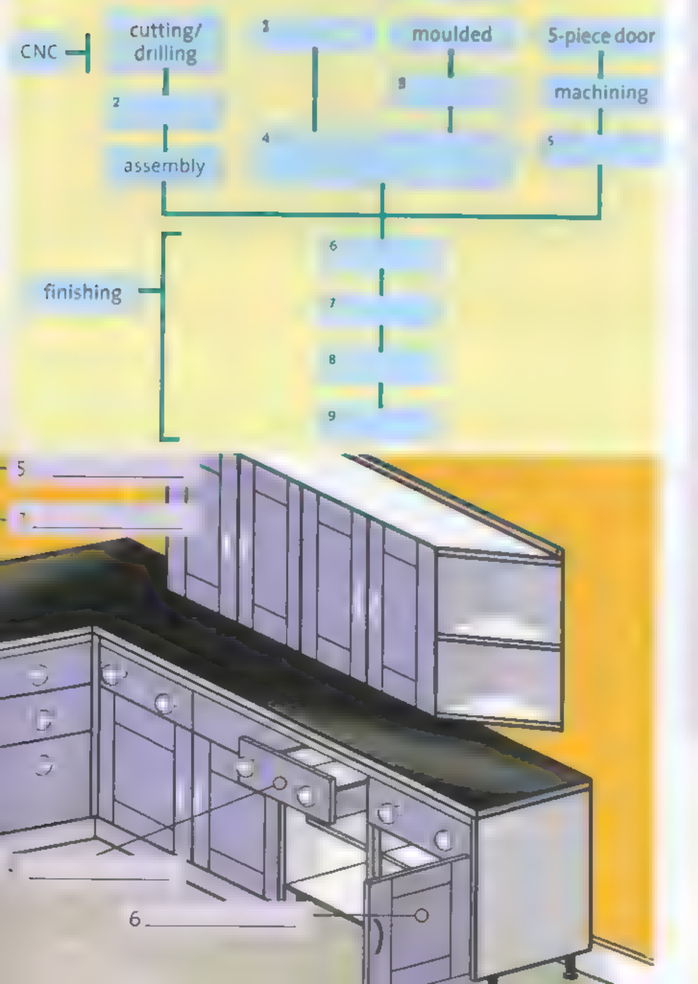
In this unit
- listening to a technical explanation
- scanning a text for information and then reading in detail to complete a flow-chart
- how to ask for information and reply politely
- phrases using the verbs *make*, *do*, *have*, and *take*

2 Scan the text to complete the tables.

Component	Materials used
carcass	
doors	
worktops	

Abbreviation	Meaning
CNC	
MDF	

3 Read the text again, this time in more detail, and complete the flowchart.



Kitchen units

Kitchen units comprise carcasses and doors which are manufactured by different processes. Most modern kitchen manufacturers use CNC machines (computer numerical control). The carcasses are generally made of melamine-faced chipboard which is fed into CNC machines. The machine cuts the required pieces to size, then drills holes for the fittings (hinges, door handles, knobs, etc.), and grooves for shelves and backs. The next stage is edgebanding – a strip of melamine or PVC the same colour as the board is glued around the raw edge.

There are three basic types of door. The slab door is the simplest. It's one piece of flat material – solid wood or board. It may be coated with acrylic, vinyl-wrapped, or lacquered.

The moulded door is normally made of MDF – medium density fibreboard. A CNC router, which is essentially a motor with a cutter mounted below it, is used to carve a pattern or moulding and then the door is coated with acrylic, vinyl-wrapped, or lacquered.

The most complex type of door is the five-piece door – a traditional door made of MDF or solid wood. It consists of five parts – two stiles, two rails, and a central panel. First, the parts are made using a variety of machine processes. The next stage for both the carcasses and the five-piece doors is the assembly.

Once assembled, the units are finished. First, the pieces pass through automatic spray tunnels. Then they are denibbed to remove any roughness, then sprayed again. Finally they pass through a drying tunnel. This is all controlled by one single computer program.

The cheapest worktop is made of chipboard which is melamine coated. Then there are a number of man-made materials such as corian, made by ICI. This material consists of several layers welded together to look as if it is all one piece. Worktops can also be made of stone, such as granite, slate, or, most expensively, marble.

The microwave oven was invented by accident! Percy Spencer at Raytheon Corporation was working on a radar research project. A chocolate bar in his pocket began to melt. He then tested popcorn and an egg and soon realized that low-density microwave energy could be used to cook food. The first microwave oven, produced in 1947, weighed over 750 pounds and was 5 feet tall.

Language spot

Question review

1 Can you remember how to make *yes/no* questions and *Wh-* questions?

Write questions for these answers

EXAMPLES

Where is the factory?

It's on the industrial estate near the river.

Can solid wood be used for carcasses?

Yes, it can / solid wood can be used for carcasses.

1 How many ________________________?

I've ordered six boxes of screws.

2 ________________________?

Yes. I saw the edgebander working.

3 ________________________?

No. They haven't got any computerized machines.

4 ________________________?

They use melamine coated chipboard.

5 ________________________?

He studied in the United States.

2 Work in pairs Ask and answer the questions above giving only the underlined part of the answer

We often use a polite form to make requests We use the statement word order. If it's a *yes/no* question we use *if* or *whether*.

Could you tell me *how much this costs?*

I'd like to know *if the material is resistant to oil.*

I'd like you to *spray both sides.*

I wonder if you could *demonstrate the router.*

Would you mind *bringing me the hinges, please?*

Notice that we use the *-ing* form of the verb after *would you mind*.

3 Make these requests more polite

EXAMPLE

What's the serial number?

Could you tell me what the serial number is, please?

1 Repeat that.

2 How does it work?

3 Email the order.

4 Answer a few questions.

5 Send us a manual.

6 When will it be ready?

7 Hold this for me.

8 What is the problem?

» Go to **Grammar reference** p.120

It's my job



1 Listen to Asma Bakour, a Kitchen Designer, talking about technology in the kitchen As you listen, note down key words Listen again if you need to

Qualifications ________________

Job title ________________

Ovens ________________

Hobs ________________

Flat screens ________________

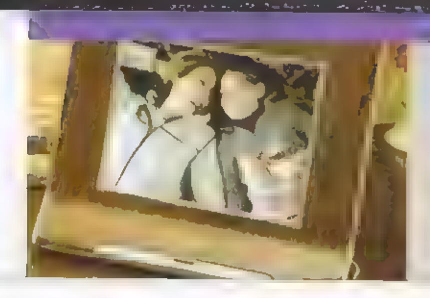
2 Work in pairs. Using your notes, take turns to ask each other questions about Asma.

EXAMPLES

A *What qualifications does Asma have?*

B *She's a Cabinet Maker and she studied Wood technology and Business at university.*

A *What did she say about the technology used in ovens?*



Gadget box

Ceiva has developed a digital photoframe that has a built-in card reader that is compatible with most formats. You can transmit new pictures to it from your broadband Internet through its built-in Wi-Fi antenna. It can be set to automatically receive new pictures from the Internet so you can send images while on your travels. www.ceiva.com

In what ways has digital photography changed the whole concept of photography?

Pronunciation

Polite requests

1 🎧 Listen to this request said in two different ways. Which one sounds polite and which one sounds rude?

A *Could you tell me how this oven works?*

B *Could you tell me how this oven works?*

To sound polite, start high and go higher on the main stressed word. Your voice should fall a bit and then rise at the end of the sentence, like this:



Could you tell me how this oven works?

Your voice should sound soft, not hard.

2 🎧 Listen to the following requests. Mark them P if they sound polite and R if they sound rude.

1 ______ 5 ______

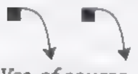
2 ______ 6 ______

3 ______ 7 ______

4 ______ 8 ______

Responding to requests

When you agree to a request, your intonation should sound polite. Your voice should start high.



Yes, of course.

3 🎧 Listen again to the requests in **2**. If they are polite, reply politely. If they are rude, say nothing.

I wonder if you could send me a catalogue, please?

Yes, of course.

I'd like you to use solid wood for the units.

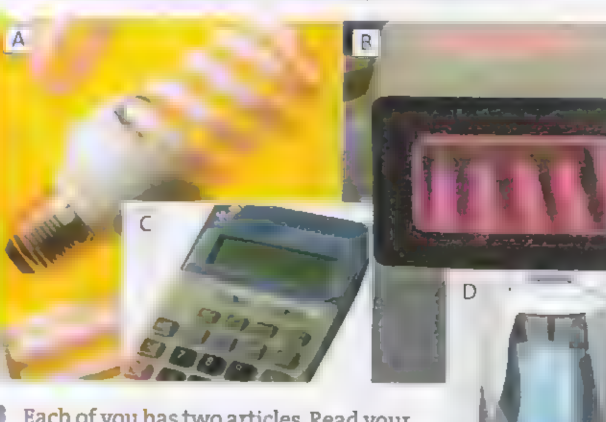
(you say nothing)

4 Work in pairs and practise the requests in **2**. You should make some polite and some rude. Your partner should only reply when the requests are polite.

Pairwork

1 Work in pairs. What do you understand by the term *global warming*? How can the design of household technology help reduce global warming?

2 Look at the pictures of four devices which have been designed to help reduce global warming. What do you think they are, and how could they be effective?



3 Each of you has two articles. Read your articles and enter the details in the table.

Student A Go to p.112.

Student B Go to p.111.

Name of the product	What it's used for	How it works	The conventional technology it replaces

4 Ask and answer questions to complete the table for the other two products.

5 In your pairs discuss how these products help reduce global warming.

Which product do you think will make the most impact? Give reasons.

Refrigerator is abbreviated to *fridge* in everyday speech.

Vocabulary

Verbs *make*, *do*, *have*, and *take*

The verbs *make*, *do*, *have*, and *take* are often used in phrases.

make a mistake	*We must be careful not to make a mistake.*
take a seat	*The manager asked us to take a seat.*

1 Put the following words in the correct column to make verb phrases. Some words can go in more than one column.

action	a decision
Engineering at university	an impact
the job	a good effect
something work well	a conference
someone a favour	a seat
research	2,000 litres
a mistake	a machine on
a rest	a machine repaired
something about it	a noise
a long time	a photograph
well	progress
someone's advice	an interesting time

make	do	have	take
a mistake			*a seat*

2 Complete the sentences with a phrase from **1**. Put the verb in the correct form.

EXAMPLE

Scientists at the university are currently doing research into the effects of global warming.

1 If you ________ the digital clock on a microwave ________ all year it will cost you €80!

2 If everyone used an eco-kettle, would it ________ on global warming?

3 When planning a new kitchen the customer has to ________ about the material for the worktop.

4 The new tanks ________

5 If people complain about the product, we will have to ________

6 There were lots of things to see and do at the trade fair and we all ________

7 The edgebander isn't working properly so we'll have to ________ it ________ .

Listening

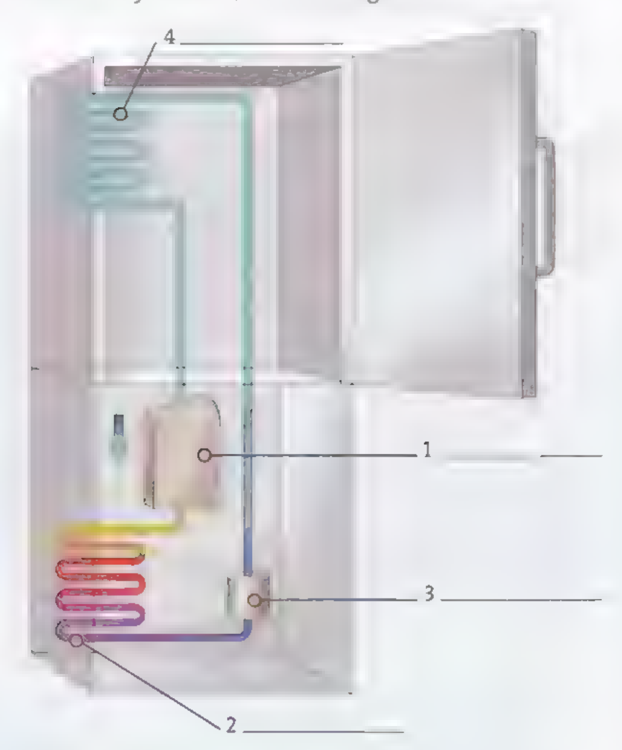
Refrigerator

1 In what ways are a refrigerator and an air conditioner similar?

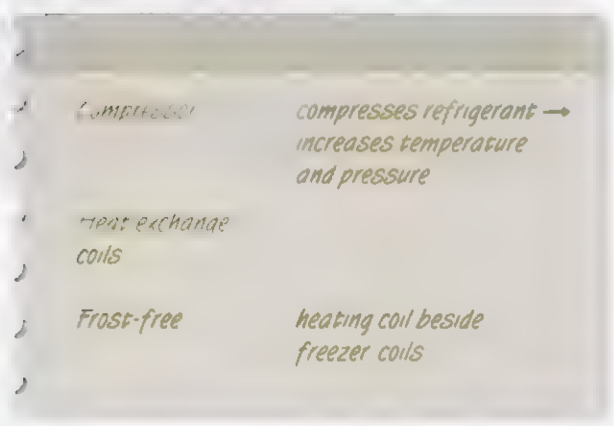
2 Match the words with the correct definitions.

1	absorb	a	to change from a liquid to a gas or vapour
2	compress	b	to take in from the surrounding surface or space
3	condense	c	to press or squeeze into a smaller space
4	evaporate	d	to change from gas or vapour to liquid

3 Listen to a lecturer explaining how a refrigerator works. As you listen, label the diagram.



4 Listen as many times as you need to. Make notes about what happens at each stage.



5 Work in pairs. Using your notes, take turns to explain how a refrigerator works and how a frost-free refrigerator works.

Checklist

Assess your progress in this unit. Tick (✓) the statements which are true.

- I can transfer information from a text to complete a flow-chart
- I can ask for information and reply politely
- I know some phrases using the verbs *make*, *do*, *have*, and *take*
- My reading and listening are good enough to understand most of each text in this unit

Key words

Adjectives
energy-saving
inner
outer
welded

Nouns
appliance
assembly
drawer
hinge
molecule
oven
panel
refrigerant

Verbs
evaporate
immerse
vibrate

Note here anything about how English is used in technology that is **new** to you.

13 Defence technology

Switch on

1 What do these examples of technology have in common?
The Internet, space rockets, satellites, GPS (global positioning system), the integrated circuit

2 Work in pairs. Can you add other examples to this list?

3 Identify the examples of defence technology in the pictures. Compare answers with your partner. Try to agree on the function of each item.





Reading

Visby: a stealth warship

1 Compare *Visby*, a Swedish warship, with a conventional ship of the same type. What differences are there? Compare answers with a partner.

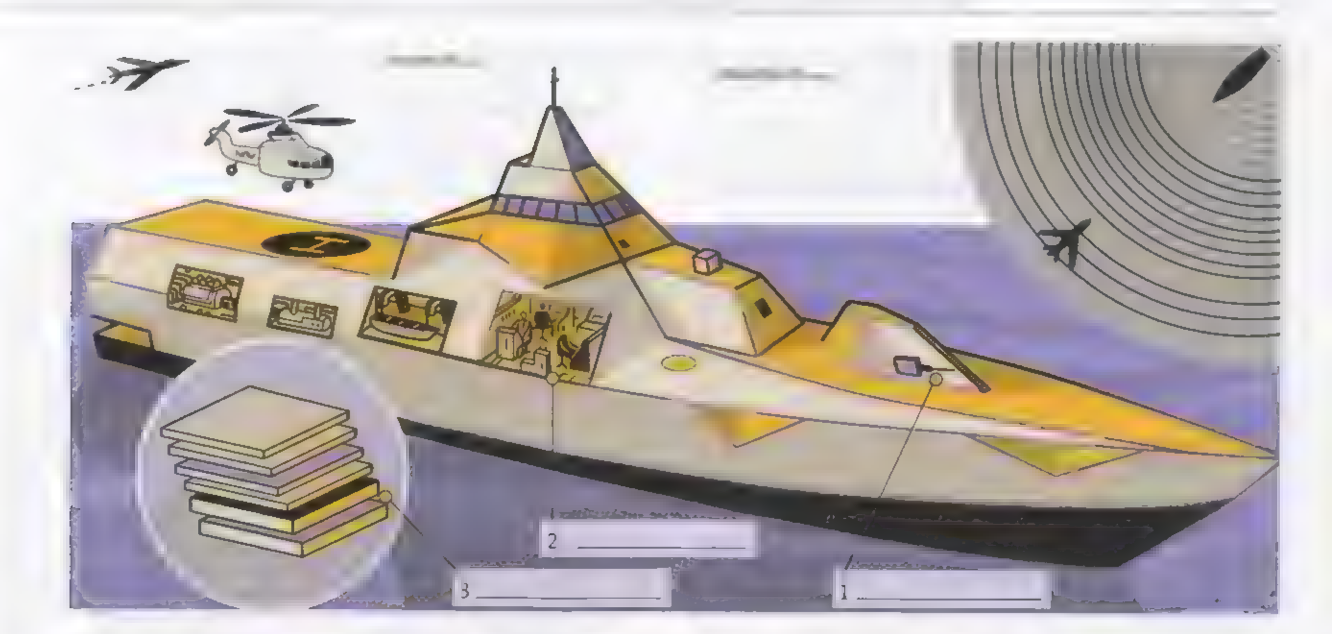


2 *Visby* is the first warship to use fully-developed stealth technology. It has been designed to avoid detection in every possible way. List the ways in which you think a ship can be detected. How could technology help prevent detection?

3 Work in groups of three, A, B, and C. Read your texts and match the underlined words to the numbered items on the diagram of *Visby*.

In this unit

- combining information from a text and diagram
- listening and note-taking from both sides of a discussion
- prepositions
- sharing information about non-lethal weapons
- how to make a poster presentation



Visby

A The hull is made of carbon fibre reinforced plastic (CFRP). It consists of layers of carbon fibre filled with a plastic foam. The material is very strong – it has to be cut with an extremely high-pressure water jet – and rigid, but has low weight. It is half the weight of a steel hull, so *Visby* can reach higher speeds than a conventional ship.

It has a low radar signature, meaning that it is more difficult to detect by radar. It also has a low magnetic signature, so is less likely to trigger magnetic mines. It has good shock resistance, which provides some protection if a mine is detonated.

The gas turbine exhaust outlets are close to the water surface so that the heat they emit cannot easily be detected.

Bow thrusters are fitted to make it easier to manoeuvre the ship in harbour.

B The *Visby* is equipped with four gas turbines for high-speed running, providing a maximum speed of 35 knots. There are two diesel engines for low speeds, providing a maximum of 15 knots. The engines are connected to two gearboxes driving two waterjet propulsors. The diesels have soundproof casings to minimize the acoustic signature of the ship.

A powerful hull-mounted sonar system is used to detect and supply target data on submarines.

The active part of the air defence system is provided by a 57 mm multi-purpose gun, which fires up to 220 rounds per minute. It is concealed in a special cover or cupola when not in use so that *Visby* does not present the radar profile of a warship.

C The Combat Information Centre is located at the centre of the ship. Communications, intelligence gathering, and defensive measures are controlled by a computer system. The system is designed to allow for future technologies to be integrated easily.

The *Visby* can launch remotely-operated vehicles (ROVs) to detect and classify mines.

The shape of the hull with large flat, angled surfaces is designed to minimize the reflection of radar waves in much the same way a stealth plane does. This gives *Visby* an advantage over potential enemies, which it can detect and respond to before it becomes visible itself. This is known as the stealth advantage

1/3 of the US fighting strength will be composed of robots by 2015.

US Department of Defense



4 Exchange information with the others in your group to complete the labelling of the diagram.

5 Study these answers to **2**. How is *Visby* designed to minimize detection by these means – what counter-measures does it use? Use the texts, the diagram, and the photograph to help you. One piece of information is not included.

Ways of detecting ships	Counter-measures
optical (by sight)	________
infrared (by heat emissions)	________
acoustic (by sound above and below water)	________
magnetically – from any ferrous metals	________
radar	________
radio transmissions	________
pressure on the water	________

Listening

The future of defence

1 Work in pairs, A and B. List the ways in which you think technology will affect future conflicts.

2 You are going to hear two defence analysts on a radio current affairs programme. They are discussing future defence technology.

Student A Listen to the first analyst and note briefly the predictions that he makes.

Student B Listen to the second analyst and note briefly his comments.

3 Using your notes, explain to your partner the viewpoint of the analyst you listened to. Decide which points you agree with.

Language spot

Prepositions review

- Study these examples of prepositions and prepositional phrases. Divide them into these categories: *time*, *place*, *movement*, and *other*.

1 *Unmanned scout vehicles will patrol* ***between*** *frontline soldiers and the enemy.*

2 *Rockets are mounted* ***on the back of*** *an armoured vehicle.*

3 *A guided missile can remain* ***above*** *the target area for up to half an hour so the target can be confirmed* ***before*** *it attacks.*

4 *The new system may not be ready before 2015 and soldiers are sceptical* ***until*** *it has been proved in action.*

5 *Any opponent who destroyed the communications network could win the battle* ***without*** *firing a shot.*

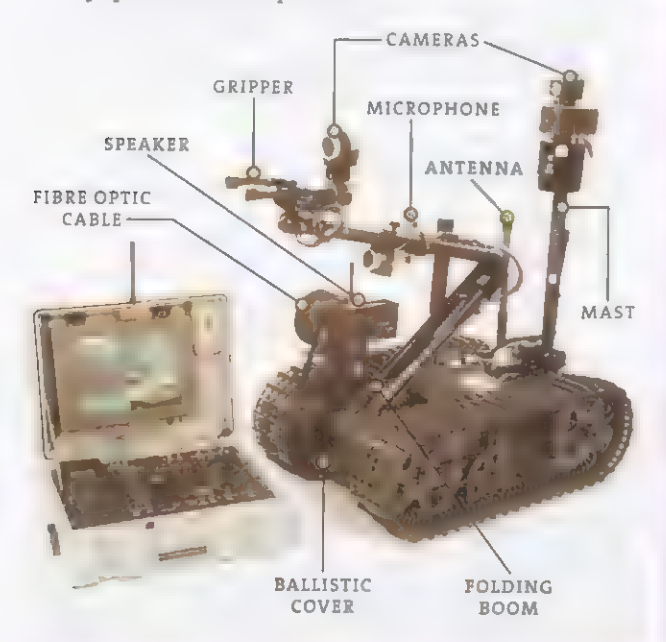
6 *The enemy moved* ***into*** *the town at night.*

- Study these additional examples. Add the prepositions from 1–6 to the table.

Time	Place	Movement	Other
after	across	across	about
at	at	along	by
between	at the back of	down	for
by	at the side of	from	of
from	at the top of	off	with
in	behind	onto	
on	below	out of	
since	beside	past	
	far from	through	
	in	to	
	in front of	up	
	on		
	opposite		
	near		
	under		

» Go to **Grammar reference** p.121

1 Study the illustration of a Talon remote control surveillance robot. Complete the text with prepositions to describe the position of some of its equipment and components.



There is a folding boom at ______________[1] of the robot. At ______________[2] of the boom is a gripper which can be used to handle suspect devices. ______________[3] the gripper is one of the seven cameras carried by the robot. At ______________[4] of the robot there is a mast. At ______________[5] of the mast there is a camera with a zoom lens. There is a speaker at ______________[6] of the robot and a microphone ______________[7] the boom to allow communication with anyone detected by the robot. ______________[8] to the mast there is an antenna which allows signals to be transmitted and received at a line-of-sight range of 1.2 km. For out-of-sight control, there is a spool of fibre optic cable ______________[9] the speaker. At the front of the machine ______________[10] the boom there is a ballistic cover to protect the robot. At both sides there are caterpillar tracks.

2 Study the map that shows the movement of Soldier X. Complete the report with prepositions of time and movement.

Using GPS, X was tracked ______________[1] the valley ______________[2] 08.40 and 09.30. He stopped ______________[3] the village ______________[4] 25 minutes. He went ______________[5] the village at 09.55. He came ______________[6] the village ______________[7] 10.35 and went ______________[8] the river by the footbridge. He walked ______________[9] the road heading north, ______________[10] the watermill, and ______________[11] the track ______________[12] the pass ______________[13] hills 300 and 301. He reached the top ______________[14] 13.50. He came ______________[15] the other side ______________[16] the harbour ______________[17] Z and went ______________[18] the ferry for Y ______________[19] 15.05.





Gadget box

Bear, Battlefield Extraction-Assist Robot, is designed to rescue wounded soldiers from the battlefield. Bear can pick up a load of 135 kg with one arm and carry this over rough terrain, thanks to its caterpillar tracks, and can climb hills pushed by its rear wheels. It has the ability to hide and move while in prone position.

Why do you think Bear has a round 'face' and 'ears'?

Pairwork

1 Work in pairs, A and B. List forms of technology which could be used in non-lethal weapons to control hostile crowds without causing serious injuries.

2 Now read about a non-lethal weapon and be prepared to describe it to your partner.

Student A Go to p.112.

Student B

Laser weapons

A number of companies are developing non-lethal laser weapons for riot control and peace-keeping operations. For example, Laser Dissuader uses red laser light to temporarily blind opponents. It can be fitted to shields so that police forces can protect themselves and incapacitate the opposition. It can be combined with blue laser light so that counter-measures such as goggles are ineffective. The US Marine Corps is experimenting with Veiling Glare Laser, a system that uses light in the ultraviolet range, which means that the eyes see only glare. One development, Pulsed Energy Projectile (PEP), uses high-energy laser and can be set to either lethal or non-lethal. It is effective up to two kilometres and is designed to explode fuel tanks and vehicle tyres, and cut communication lines.



3 Exchange information with your partner. Together think of countermeasures to resist these weapons.

Problem-solving

Work in groups. Choose one of these examples of military technology and discuss ways in which they are used in civilian life, and what possible future civilian applications they might have. Share your ideas with the rest of the class and decide which possible applications are most likely.

1 unmanned vehicles and aircraft
2 stealth technology
3 weapons guidance systems
4 robot soldiers
5 sonar devices

Webquest

1 Decide on a topic in technology. You can choose any of the topics covered in this book, or a topic of your own. Here are some ideas:

- How something is made, e.g. petroleum, aircraft, batteries, printed circuits
- How something works, e.g. a jet engine, a high-definition TV, radar, RSS feeds
- Future developments, e.g. energy sources, homes, consumer products, defence technology
- A process, e.g. electroplating, water jet cutting

2 Research your topic. You are going to use the information you find to make a poster presentation. In addition to your college library, you can search for online sources.

www.howstuffworks.com

www.wikipedia.org

You can find pictures and other graphics on Google Images, but remember these may be copyright. You **must not** publish them on a webpage or blog or in print form without permission of the copyright holder.

Checklist

Assess your progress in this unit. Tick (✓) the statements which are true.

- I can combine information from a technical text and a diagram
- I can listen for main points and make notes
- I can use prepositions
- My reading and listening are good enough to understand most of each text in this unit

Make your point

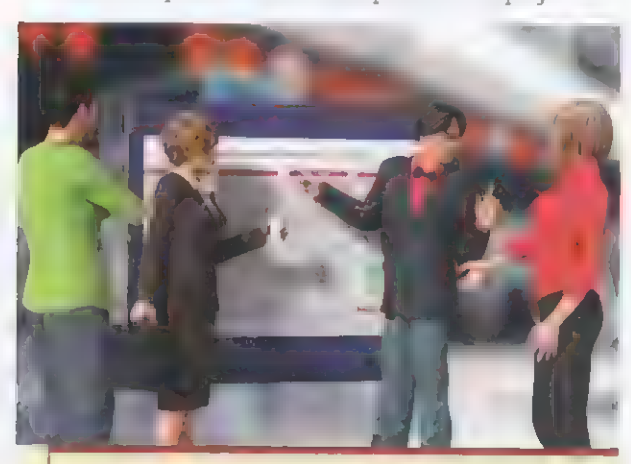
Giving a poster presentation

You can do this individually or in small groups of three, providing everyone contributes equally. You need one large sheet of paper for your poster. Refer to the *Poster design* ideas from Lee Avatar.

1 Decide on the main points for your presentation and write the text for each point. Keep it brief. Use images where possible.

2 Decide on the layout. Print out your texts and graphics and fix them to your poster.

3 Pin up your poster and be prepared to explain any points to your classmates. Take time to view theirs and to ask one question about each poster on display.



POSTER DESIGN

- Make your poster pleasing to look at by using colour and graphics.
- Make sure the text can be read easily from about 1.5 metres.
- Have a clear heading so it is easy to see what your topic is.
- Make sure that it is easy to follow the correct order of your presentation. Use numbers, letters, or arrows.
- Don't fill every square centimetre. Leave white space and separate out the sections.
- Distribute text and graphics evenly with enough text to explain the graphics.

Key words

Adjectives
armoured
high-tech
non-lethal
stealth
uncrewed
unmanned
visible

Nouns
countermeasure
hacker
hull
radar
sonar
warship

Verbs
minimize
trigger

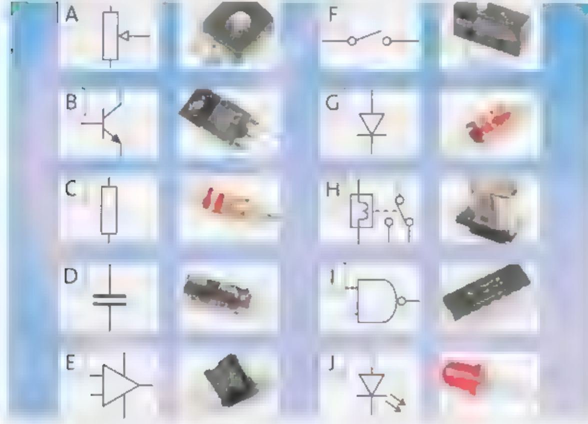
Note here anything about how English is used in technology that is **new** to you.

14 Electronics

Switch on

Match 1–10 with the circuit symbol diagrams A–J.

1 amplifier
2 capacitor
3 diode
4 resistor
5 light-emitting diode
6 NAND logic gate
7 relay
8 npn transistor
9 switch (single-pole, single-throw)
10 potentiometer (pot)



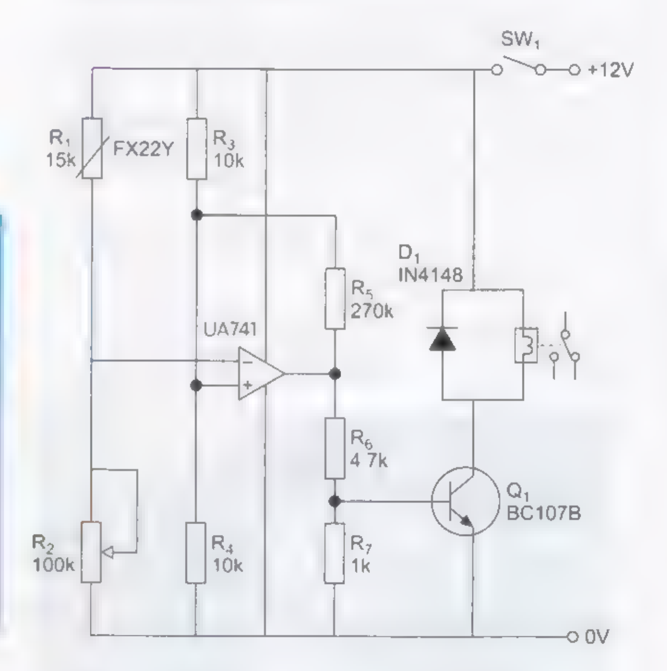
Reading

Electronic alarm circuits

1 Work in pairs. Make a list of electronic alarms in column A. Note what triggers the alarm in column B. Two examples are completed for you.

A	B
Alarm	Trigger
motorcycle anti-theft	*moving the motorcycle*
fridge door	*leaving the fridge door open*

2 Study this circuit. Make a component list with the numbers, names, and values of each component. Say what the circuit is used for.



Component	Type	Value/reference number
R1		
R2		
R3		
R4		
R5		
R6		
R7		
D1		
Q1		
SW1		
	operational amplifier	UA741

In this unit

- discussing and reading about electronic circuits
- describing how electronic circuits operate by using complex sentences
- listening to an interview with an electronics technician
- words which often go together in electronics
- how to evaluate and improve presentation skills

3 Now read the description of how the device works. Then put the events in the correct sequence. The first and last events are entered for you.

a The relay is activated. ________

b Current flows through the collector-emitter circuit. ________

c The voltage in the base-emitter circuit rises above 0.7 volts. ________

d The resistance of R1 rises. ________

e The warning device is switched on. 7

f The temperature falls. 1

g Small differences in voltage are amplified by the amplifier. ________

A circuit diagram

The diagram shows a simple frost alarm. It can be used to warn drivers that roads may be icy or to warn gardeners and fruit farmers to protect their crops. It can also be used to switch on heaters. It is triggered by a fall in temperature. When the temperature falls to 0°C or any temperature selected, the alarm operates.

The principal component is the thermistor, R1. As the temperature falls, the resistance of R1 rises. At 25°C it has a resistance of 15 kΩ. At 0°C the resistance is 45 kΩ. The 100 kΩ potentiometer, R2, can be adjusted to allow the circuit to trigger at other temperatures.

The higher the resistance of R1, the smaller the voltage flowing to the amplifier, UA741. This is a very sensitive amplifier which amplifies small differences in voltage. The output from the amplifier is fed to the base of the transistor, BC107B. This acts like a switch. When the voltage in the base-emitter circuit rises above 0.7 volts, current flows through the collector-emitter circuit, activating the relay. The diode, D1, across the relay prevents sparking. R5 helps to ensure the relay changes smoothly when the trigger temperature is reached. The relay can trigger a warning device such as a buzzer or light, or switch on a heater.



Language spot

Complex sentence review

- We can use complex sentences of two or more clauses to describe how a series of events relate to each other.
- Study these ways of forming complex sentences:

- Using time clauses to link actions

1 ***When the temperature falls***, *the alarm is switched on.*

2 *A capacitor charges* ***until it is full***.

3 ***As the capacitor charges***, *the voltage rises.*

- Using *if*-clauses to link a cause and effect

4 ***If excess current is passed***, *the transistor will overheat.*

- Using relative clauses to make definitions

5 *Diodes are electronic devices* ***which allow current to pass in one direction only***.

- Using relative clauses to add information. We use commas to show this is extra but not essential information.

6 *Diodes,* ***which are made of silicon or germanium***, *have many uses in electronics.*

- We can replace *which* or *who* in a relative clause followed by a Continuous or Simple verb with an active participle, the *-ing* part of the verb.

7 *This completes a circuit,* ***which generates a series of pulses***.

OR

8 *This completes a circuit,* ***generating a series of pulses***.

Now note how we can link these events in the frost alarm circuit.

1 *The temperature falls to zero.*

2 *The transistor is switched on.*

3 *This activates the relay.*

1+2 *When the temperature falls to zero, the transistor is switched on.*

2+3 *The transistor is switched on, which activates the relay.*

1+2+3 *When the temperature falls to zero, the transistor is switched on, which activates the relay.*

OR

1+2+3 *When the temperature falls to zero, the transistor is switched on, activating the relay*

» Go to **Grammar reference** p.122

1 Make sentences by matching the information in columns A–C and then linking it together using a relative clause with *which* or *who*.

EXAMPLE
Silicon, which comes from sand, is an important component of some semiconductors.

	A	B	C
	Subject	**Additional information**	**Important information**
	Silicon	It is short for binary digit.	He was one of three inventors of the transistor.
1	Digital electronics	He worked at Bell Laboratories	They are remembered in the basic units of electricity.
2	Walter Brattain	This means light-emitting diodes.	They are used in watches and many electronic displays.
3	A bit	It is used in everything from watches to computers.	They can provide a higher current than other batteries.
4	Lithium batteries	They were p oneers in the study of electricity.	It is an important component of some semiconductors.
5	LEDs	It comes from sand.	It is concerned with electrical systems made up of a series of switches.
6	Ohm, Volta, and Ampère	They are often used in cameras.	It is a single unit of information.

2 Link each pair of events to make one complex sentence. Use the clue in brackets to help you.

1. A milliammeter is a device. It measures very small currents. (relative clause)
2. A residual current device trips. An excess current passes through a circuit. (time)
3. Light strikes the solar cell. This generates a voltage.(relative clause)
4. An electrolytic capacitor is connected wrongly. The capacitor will be damaged. (condition)
5. You touch memory chips. Make sure you are earthed. (time)
6. D-type connectors come in a variety of sizes. D-type connectors are widely used for linking devices to computers. (relative clause)
7. A relay is an electro-mechanical switch. It uses an electromagnet. (relative clause)
8. The input signal to an inverter is 1. The output signal will be 0. (condition)
9. A signal is detected. It is amplified. (time)
10. A logic probe is a test instrument. It provides an easy way of checking simple logic circuits. (relative clause)

It's my job



1 Answer the questions.

1. What subjects do you think are included in an Electronics course?
2. What sort of work can an Electronics Technician do?
3. What's the link between lighthouses and electronics?

2 Listen to the interview with Brian Jones, an Electronics Technician. Answer the questions.

1. How did he become interested in electronics?
2. Why did he like the lab work at college?
3. Why did he give up his repair business?
4. What is the Marine GDPS and why is it important?



Gadget box

Printable batteries thinner than paper are being developed by a number of companies. They are flexible, cheap, and rechargeable and range in thickness from 0.6 mm to 300 microns, the thickness of a human hair. They can be used for talking greeting cards, smart cards, RFID (Radio Frequency Identification) tags, and many other applications.

What other applications are there for printable batteries?

5 Why does he visit remote places?

6 Why is he not thinking of changing job?

3 Listen to the interview again. Write down the interviewer's questions.

4 Work in pairs. Compare your versions of the interviewer's questions. Role-play the interview.

5 Listen again to compare your version of the interview with the recording.

Pronunciation

Reading component values

1 Identify these components.

Symbol	Component and value
(mA)	

2 Listen to the recording and note the values.

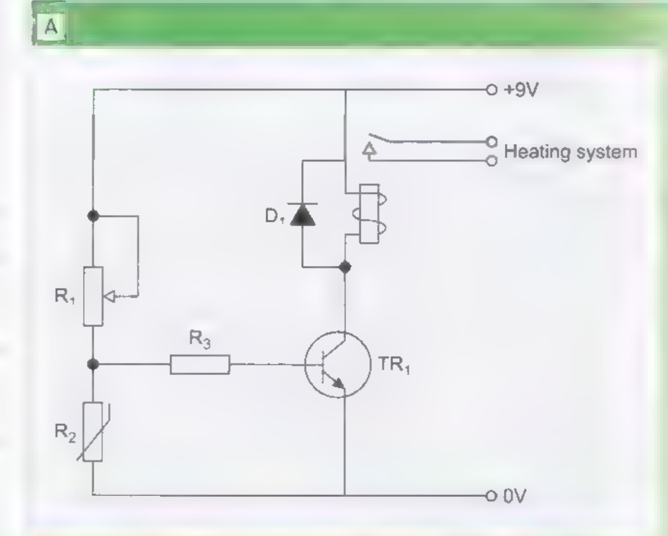
3 Practise saying the component values aloud.

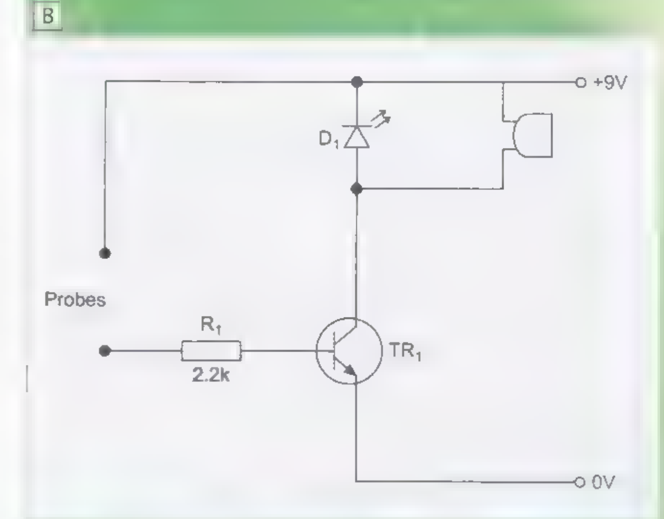
4 Listen again and compare your pronunciation to the recording.

Problem-solving

1 Work in groups, A and B. Study one of these circuits, A or B. Decide what the circuit is for and prepare a detailed explanation of how it works.

2 Work in pairs with someone from the other group and explain to them how your circuit works. Be prepared to answer any questions your partner may have.





There is enough silicon in 10 grains of sand to build the electronic circuits in a small computer.



3 Complete the explanations of circuits A and B using the words below. You will not need to use all the words.

activates	current	probes
battery	diode	relay
bell	emitter	resistor
buzzer	falls	rises
capacitor	flow	temperature
chip	if	thermistor
circuit	light	transistor
collector	off	value
conduct	on	sound
contacts	open	switch

A

This is a thermostat to control the operation of a central-heating system. The ________[1] changes in resistance with the ________[2] in the room. This alters the voltage in the base-emitter ________[3], turning the transistor ________[4] if the temperature falls below a pre-set ________[5]. This allows a ________[6] to flow in the ________[7]-emitter circuit which ________[8] the relay, closing its ________[9] and switching on the system. If the temperature of the room ________[10] above the pre-set value, the thermistor will ________[11] the transistor and the heating system ________[12] in the same way.

B

This is a device to detect moisture. The components are: npn junction ________[1], light-emitting ________[2], 2.2k________[3], a buzzer, two probes, and a 9-volt ________[4]. No current flows in the base-emitter circuit when there is air between the two ________[5], so the transistor is turned off. ________[6] the probes are placed on a damp surface, the moisture will ________[7]. A current will ________[8] to the base, turning the transistor on. Current then flows from the battery to the ________[9]-emitting diode and the ________[10], giving both visible and audible warning.

Vocabulary

Collocations in electronics

1 Look at the table. In electronics, the verbs on the left commonly occur with one or more of the nouns on the right. See how many matches you can make.

Verb	Noun
actuate	a capacitor
adjust	a circuit
amplify	a control
boost	a current
change	frequency
charge	an output
complete	a relay
detect	a signal
discharge	a voltage
energize	
generate	
induce	
modulate	
produce	
step down/up	

2 Complete the sentences using the correct form of an appropriate verb from **1**.

1. The transformer ________ the voltage from 240v to 9v.
2. ________ the control so the meter reads zero.
3. With low levels of light, solar cells ________ very low voltage.
4. When the circuit is switched off, the capacitor keeps it operating until it ________
5. The changing magnetic flux ________ a voltage in the secondary of the transformer.
6. Changing the capacitor will ________ the frequency of the oscillator.
7. Pressing the switch ________ the circuit, allowing current to flow.
8. If the relay is ________, the contacts close.
9. The IR receiver ________ and decodes the signals from the remote control.
10. In the final stage, the signal is ________ and fed to a loudspeaker.

Make your point

Evaluating a presentation

1 Work in pairs. Study Lee's checklist. Is there anything you would like to change or to add?



POOR = 1 EXCELLENT = 5

1 CONTENT
Was the speaker well prepared?
Was the speaker knowledgeable about the subject?

2 ORGANIZATION
Was there an introduction? Was there a conclusion?
Was the talk well organized?

3 DELIVERY – VOICE
Was the speaker enthusiastic and convincing?
Did the speaker make the subject interesting?
Did the speaker speak clearly enough?
Was the speed right for you?
Did the speaker read the presentation or talk from notes?

4 DELIVERY – MANNER
Was the speaker relaxed?
Did the speaker use appropriate gestures?
Did the speaker make eye contact with the audience?
Did the speaker involve the audience with questions or activities?

5 VISUAL AIDS
Did the speaker use visual aids? Were they easy to see?
Did they help you understand?

2 Prepare and deliver to your class a short presentation (maximum five minutes) on a topic of your choice. Evaluate each other's presentations using Lee's checklist or your revised version of it.

Checklist

Assess your progress in this unit. Tick (✓) the statements which are true.

- I know basic terms used in electronics
- I can describe how electronic circuits operate
- I can evaluate a presentation
- My reading and listening are good enough to understand most of each text in this unit

Key words

Nouns
capacitor
current
diode
frequency
oscillator
pulse
relay
resistor
switch
transformer
transistor

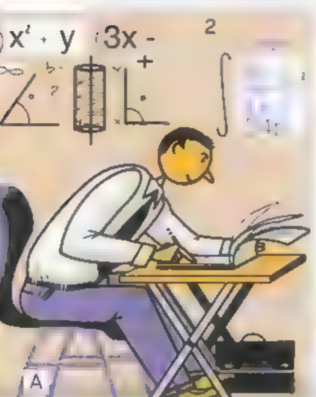
Verbs
amplify
conduct
induce
modulate

Note here anything about how English is used in technology that is new to you.

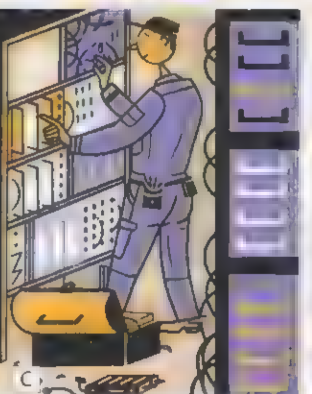
15 Career development

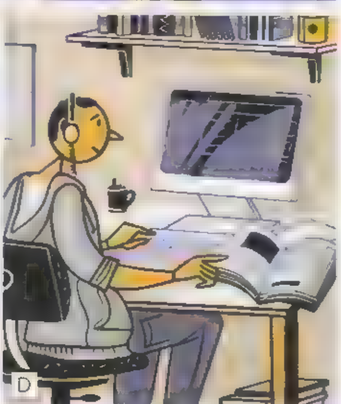
Switch on

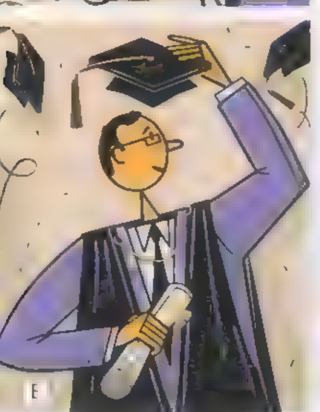
Look at the pictures. They show Sami Hassan at different stages in his career. Discuss with a partner what he is doing at each stage.

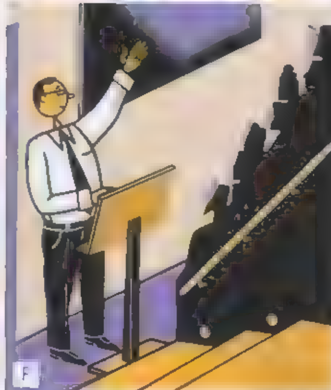

A


B


C


D


E


F

Listening

Interview with a Network Designer

1 Listen to Sami describing his career path to becoming a Network Designer. Complete the table with what Sami was doing at different ages.

16	Sitting exams at school
17	
18	
20	
23	
25	

2 Listen again and answer the questions.

1 What subjects did Sami study at school?
2 What does a Service Technician do?
3 What did he like about the job?
4 What were his responsibilities at the exchange?
5 What qualifications did he have by the time he was 20?
6 What did he learn when he joined the Network Design department?
7 What did he study at university?
8 What has he had to learn as a Network Designer?

3 Work in pairs, A and B.

Student A You are Sami.
Student B You are an interviewer.

Ask and answer questions about Sami's career.

EXAMPLE

A *What did you study at school?*
B *Maths and Physics.*
A *When did you leave school?*
B *When I was 16.*
A *What did you do next?*
B *I applied to do an apprenticeship with BT.*
A *Why?*

In this unit

- review how to talk about the future
- how to prepare for a job interview
- how to write a covering letter
- technology game reviewing language, career knowledge, and skills from Units 1 to 15

Language spot

Future review

I expect the interview won't be very difficult.
We're going to check the switching equipment at the exchange.
We're attending the conference in Milan on Thursday.
It'll probably take two hours to fix.
She's going to apply for a new job.
I'm moving to a new department next month.

1 Underline the verb forms used to talk about the future in the sentences above. Match verb forms a–c with their uses 1–3.

a *will*	1 intentions and predictions based on evidence
b *going to*	2 plans and arrangements
c Present Continuous	3 expectations and predictions without evidence

>> Go to **Grammar reference** p.123

2 Complete the sentences with the most suitable future form of the verb in brackets.

a We __________ (start) the training course on Monday. I've got the details.

b Mary says she __________ (look) for a job with more responsibility. Good idea!

c I know there __________ (be) problems, there always are!

d __________ you __________ (discuss) the information storing project at the meeting?

e When do you think the company __________ (introduce) the next generation of mobile phones?

f I __________ (meet) the supplier tomorrow morning. We __________ (discuss) technical specifications.

3 Make a list of three things you have arranged to do in the next few days and three things you intend to do in the future. One thing in each list should be untrue.

EXAMPLES

I'm not coming to the lesson next week.
I'm going to study Electronics at university.

4 Work in pairs. Read your sentences to your partner. Your partner should guess which sentence is untrue.

5 Work in pairs. Make predictions about life twenty years from now. Discuss these topics or choose topics of your own.

- your company activities
- your job
- telecommunications
- mobile phones
- communication technology

Vocabulary

Key skills

1 Match a word / phrase in A with a word / phrase in B

	A	B
have	a good attendance technical good communication an industry	ability background record skills
be	a good team a good decision well good at	maker organized multitasking worker
want	promotion work job flexible	experience opportunities working hours satisfaction

2 Work in pairs. Write about people you know using phrases from the table in **1**.

EXAMPLE

Olaf has an industry background. He worked for Siemens for four years.

Make your point

Preparing for an interview

1 How would you prepare for an interview? Work in pairs and make a list of key points.

2 Look at the checklist Lee Avatar gives his clients. How many of these points did you think of?

3 Can you think of any other points that would be important in your culture?

4 Read the common questions he mentions again. Spend ten minutes thinking about how you would answer these questions in an interview.



- Find out who you will be talking to. The department boss will ask specific task-related questions and someone from Personnel will ask about your general skills.
- Find out about the company – their products and services, customers and competitors.
- Prepare for some common questions that are often asked during an interview.
  What are your strengths and weaknesses?
  Why do you want to work for us?
  What did you like most in your last job?
  How do you get on with other people?
  Do you work best on your own or in a team?
  How do you manage multitasking?
  How do you deal with stress?

Read more of these typical questions at www.jobcentreplus.gov.uk or by searching, for example, on Google.

- Be positive
- Give relevant answers
- Ask questions
- Wear smart, business-like clothes
- Get to the interview early

5 Work in pairs. Role-play an interview situation. One of you is the interviewer and the other the applicant. Ask and answer the questions you noted down in 4. When you have finished, discuss each other's performance and how to improve.

Reading

Job ad and covering letter

When you apply for a job, you normally send an application form and your CV. You should also send a covering letter. This should get the employer's attention and make a positive impression.

1 Read the advertisement and answer the questions.

1 What job is being advertised?
2 Who should apply?
3 What should you do if you are interested?

Anglo Telecom is looking for a

NETWORK DESIGNER

AT is a multinational organization. Due to company expansion we now require a Network Engineer to work on our 21st-century development project. You will work on a wide range of networking technologies and be involved in all areas of the project.

The ideal candidate will have a university qualification in Telecommunications engineering or a related subject and some experience in switching and transmission. Strong communications skills are necessary and you will work effectively in a team. Experience of working with different cultures would be an advantage.

Please send your CV and covering letter to Dominik Abraham, Network Planning Department, Anglo Telecom, High Row, London, NW12 6PE.

2 Read and complete the letter on p.107 with these words.

ability	opportunity	responsibility
application	reference	team
experience	response	

3 Work in pairs and discuss the questions.

1 Does Anna have the right qualifications for the job?
2 Do you think Mr Abraham will be interested in her application? Why? / Why not?

milk round (n) a series of visits that large companies make each year to colleges and universities, to talk to students who are interested in working for them

234 Castle Rise
Kingston
AB9 6XX
0144 612398
mobile:1077986543
email:
as@home.co.uk

Mr D Abraham
Network Planning Department
Anglo Telecom
High Row, London
NW12 6PE

24 August 2008

______________ [1]: application for Network Designer

Dear Mr Abraham

In ______________ [2] to the advertised position for a Network Designer in the Telecommunications Engineering Journal on 18 August 2008, I am writing to ask you to consider my ______________ [3]. I am looking for the opportunity to gain experience in this field.

I gained hands-on ______________ [4] in switching and transmission while studying for my NVQ in Manchester and was fortunate enough to spend six months in Sweden with Telia as part of an exchange programme. While there, I worked on maintenance and fault-finding at the exchanges as a Network Technician and was given ______________ [5] for implementing new systems. I gained valuable experience of working as part of a ______________ [6] and in communicating with others.

I am very interested in joining a leading telecoms company such as Anglo Telecom. My NVQ results show that my technical ______________ [7] is excellent and I am very conscientious about meeting deadlines. I have excellent computing skills and a very positive attitude to learning new skills.

I would appreciate the ______________ [8] to meet you to discuss my application and look forward to hearing from you.

Yours sincerely

Anna Suchard

Webquest

Visit *Milkround.com* and enter a sector that you are interested in, such as *Engineering*, in the *Search* box, then find a job you think is interesting and follow the link. When you have done your research, write a covering letter for the job.

www.milkround.com/s4/jobseekers/

Speaking

Second interview task

For some jobs you may be interviewed twice. After the first interview, the employer will produce a short-list of suitable candidates: usually no more than three. If you are invited to a second interview, you will probably be asked to prepare and perform a task.

1 Imagine you have been invited for a second interview. Make a poster of an ironing board with at least two drawings showing the ironing board set up and folded. Annotate the drawing with information about parts and materials used. You have 20 minutes to prepare.



2 Work in groups. Present your work to your group of students and listen to other students giving their presentations. When you have finished, discuss what you have done well and think about how you could improve in the future. Use the checklist in *Make your point*, Unit 14, p.103 to make constructive comments.

3 Decide on the best piece of work in your group. As a group, present it to the rest of the class.

Technology game

This game revises what you have learned in this book. Work in groups of six. Divide into three pairs. You need one dice for each group and a counter for each pair.

Rules

Decide who is going to start. Place your counters on the start square. The first pair throws the dice and moves their counter to the correct square. Read the instructions aloud. You are allowed one minute to discuss your answer. (The other pairs should also think about the answer.) Give your answer in no more than one minute. If you cannot answer, another pair can offer an answer.

If another pair thinks that the answer is incorrect they can challenge and offer another answer. If they get the correct answer, they can move their counter along one square. It is now their turn to throw the dice. If the answer is correct and there is no challenge, the pair rolls again.

The first pair to reach **Finish** is the winner.

Red squares give instructions

Yellow squares test your career skills and knowledge

Green squares test your speaking skills

Brown squares test your language knowledge (grammar, vocabulary)

a), b), c) squares

If there are a), b), or c) questions, the first pair to land on the square can choose which they want to answer. The next time a pair land on that square, they must answer a different question. If the square has only one question, the next pair to land on the square must give an answer that is different to the first pair.

Talk about squares

If the instructions tell you to *Talk about* ..., you must talk for 30 seconds.

Good luck!

1 START
Name 3 different college courses where you could study Technology.

2 Talk about a route you could follow to develop your future career.

5 Give 2 sentences you could use in a presentation.

6 Talk about what
a you have been doing.
b you did yesterday.
c experiences you have had.

9 Talk about
a how a bridge is constructed
b how a tunnel is constructed.

10 Name 3 sources of renewable energy.

13 Describe a bridge you know – type, location, function.

14 Talk about how one form of renewable energy works.

17 What can you say if you don't understand someone?

18 Name 2 different forms of transport that use
a water b air
c rails.

21 Give 3 advantages to an earth home.

22 Move forward 1 square

25 Make 2 sentences about what you do and 2 sentences about what you are doing.

26 Give 2 expressions you could use in a presentation to
a start
b finish.

29 Describe
a 2 steps in water treatment
b 2 features of an eco-city.

30 Name 2 roles of an Environmental Scientist.

33 Take a break – miss a turn.

34 Talk about a type of technology designed to save energy.

37 Draw and describe an electronic circuit symbol.

38 Make a sentence that has
a 2 prepositions of time
b 2 prepositions of place
c 2 prepositions of movement.

41 Give a noun that could follow the verb:
a amplify b generate c modulate.

42 Name 2 skills you have that you would mention in a letter of application.

3 What follows these verbs: -ing or to + infinitive?
a avoid, suggest, enjoy
b decide, learn, aim.

4 a What is precision agriculture?
b Name two ways of preserving food.

7 Go back to the start

8 Name 2 different types of bridge.

11 Make 2 sentences to say what manufacturers can/are able to do with plastics.

12 a Name 2 different plastics and what they are used for.
b Give 3 properties of plastics.

15 a Give 3 verbs that describe movement in mechanisms.
b Give 3 adjectives that describe shape.

16 Name 3 parts of an aeroplane and give their function.

19 Give 2 things you
a must do
b mustn't do
if you want to build a house.

20 Describe 3 features of a home of the future.

23 Make 2 sentences to compare
a cars and bicycles
b trains and buses.

24 Name 2 parts of a drilling rig and give their function.

27 Give 2 examples of robots and say what they do.

28 Make 2 phrases with the words
a technology
b waste
c water.

31 Make 2 sentences with the words
a cause
b prevent.

32 Name 3 domestic appliances.

35 Ask your partner to do something politely. Your partner must reply.

36 When giving a presentation, give 2 pieces of advice about
a organizing b visual aids
c delivery.

39 Make 3 statements about
a your plans for the rest of the week
b your predictions for life in 20 years' time.

40 Describe 2 forms of technology that have been developed to avoid warships being detected.

43 Give one way you can ask for clarification if you haven't heard someone clearly.

44 Give 2 pieces of advice about how to prepare for an interview.

FINISH

Checklist

Assess your progress in this unit. Tick (✓) the statements which are true.

I can talk about the future

I know how to prepare for a job interview

I know how to write a covering letter

My reading and listening are good enough to understand most of each text in this unit

Key words

Nouns
ability
applicant
application
attendance record
candidate
covering letter
decision maker
multitasking
opportunity
promotion
reference
responsibility
skill
team

Verbs
apply

Note here anything about how English is used in technology that is new to you.

Pairwork activities

Unit 1 p.4

Student A

1 Transmission systems, Engine management systems, Diagnostics, including using electrical and electronic test equipment

4 Electric power, Materials and manufacture, Mathematics

5 Aeroplane aerodynamics, Gas turbine engines, Propellers

8 Audio recording, Sound creation and manipulation, Computer music production

Unit 6 p.39 Make your point

Student B

Boeing 747-8
Cruising speed: 913 km/h
empty weight: 185,972 kg
max take-off weight: 439,900 kg

Aviation weather report at 0800 UTC on 16 June
Temperature: 16°C
Dew point: 2°C
Pressure: 1024 hPa

Unit 2 p.12

Student A

Orange growers have always had the desire to make their oranges as orange as possible! Oranges grown in some parts of the world are dull and lack colour because there are no cold nights, while those grown in areas with cool nights are usually brighter in colour. Now, orange growers take their freshly-picked oranges to large buildings where ethylene gas is used to stimulate the chlorophyll in the oranges to bring out more natural colour. After that, each fruit is photographed from every possible angle using a digital camera. Computers use these pictures to record any undesirable marks on the skin at the same time as analyzing the size, colour, and shape of each orange. Depending on the demands of the market, the grower can set the required grade specifications in the computer. Any oranges which do not meet the required standards are removed from the production line and later used to produce juice.

Unit 11 p.83 Speaking

Student A

A

HeartLander is an experimental miniature robot designed to allow surgeons to treat damaged hearts without major surgery. It has been developed at Carnegie Mellon University in Pittsburgh. The robot is two centimetres long. It can be inserted into the body by a small incision in the chest. It moves by a combination of suction and push-pull movements provided by wires driven by motors outside the body. The movement resembles the way a caterpillar moves. It can travel at speeds of up to 18 cm per minute.

A computer monitors its position and controls its movements.

HeartLander can be directed to crawl over the surface of the heart while the heart is beating. Its inventors hope to use it to attach leads for pacemakers, to inject drugs straight to the heart, and to take samples from the surface of the heart for analysis.

To do this without major surgery would be an important advance in the treatment of heart problems.

Unit 8 p.48

Student B

The Japanese Shinkansen network of high-speed railway lines extends for several thousand kilometres. The system was based on existing rail technology, but designers tested model trains in a wind tunnel to make them aerodynamic in design and so reduce air resistance. Because of the shape, the trains have been called 'bullet trains'. Electric or diesel engines power the trains which travel up to 300 km/h on standard gauge, purpose-built track. Certain constrictions had to be eliminated, such as level crossings, frequent stops, and some curves. Similar high-speed rail networks exist in other countries, for example the TGV in France. They allow travel from city centre to city centre, rapid boarding time, and comfort. They are considered environmentally efficient and are seldom affected by poor weather.

Unit 6 p.38

Student A

1 ____________

2 ____________

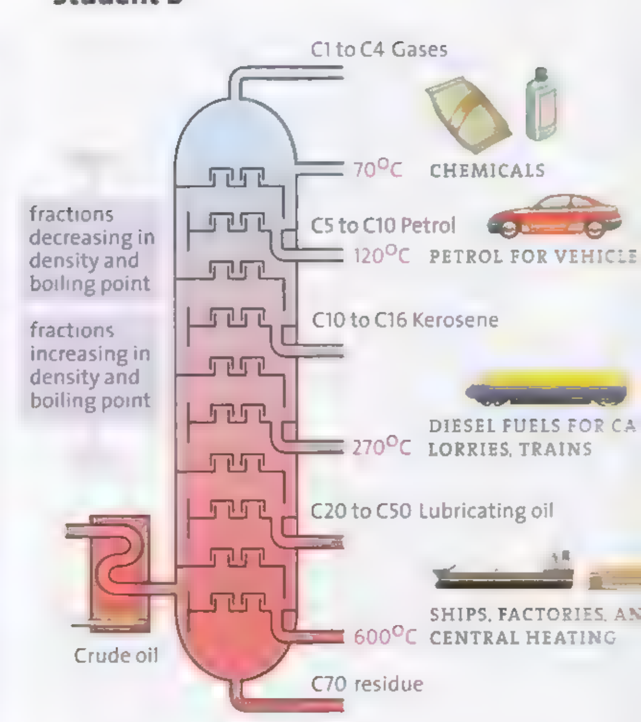
3 ____________

4 ____________

Helicopters are known as rotary-wing craft because of the rotating blades or wings. The main rotor is mounted on the top of the helicopter. The blades have an aerodynamic shape and as they spin they provide lift. A gas-turbine or petrol engine below the shaft provides power for the rotor, which also provides thrust. Most helicopters also have a tail rotor attached to a tail boom. This provides thrust in a sideways direction and prevents the helicopter from spinning. The pilot controls direction using both hands and feet. He / she can change the angle of each blade so that they produce more thrust on one side than on the other. This creates a difference in lift and so causes the helicopter to tip and move forward, backwards, and sideways.

Unit 9 p.71

Student B



Unit 12 p.89

Student B

The Wattson is an attractive-looking device that shows how much energy is being consumed at any point of time. A clip attaches a small transmitter around the electricity cable beside the electricity meter. This provides a wireless connection to the Wattson, which can be placed anywhere in the house. The device glows in blue or red electroluminescence. Blue indicates low energy use while red indicates high. It also provides hard data on energy consumption and can show how much it costs to leave a specific appliance on for a year

Compact fluorescent bulbs (CFLs) are used in place of conventional incandescent light bulbs. A fluorescent tube is filled with mercury vapour. An electrical discharge through this mercury vapour emits ultra-violet light. This makes a coating inside the tube glow brightly, producing about four times as much light as a conventional bulb with the same wattage. The first energy-saving bulbs were long and large, but using electronics in the base of the bulb has reduced the size

Unit 1 p.4

Student B

2 Introduction to telecommunications, Electronics, Microprocessors and microcontrollers

3 3D modelling, Operating systems for CAD users, Communication skills

6 Ship performance at sea, Marine machinery systems, Offshore engineering

7 Ordnance, munitions, and explosives, Guns and vehicles, Sensor systems

Unit 6 p.39 Make your point

Student A

Boeing 747-8
Fuel capacity: 216,840 litres
Maximum range: 8,000 nautical miles
People capacity: 467 (3-class)

Aviation weather report at 1300 UTC on 30 January
Wind – 5 knots from 140 degrees SE, variability 110 – 270 degrees

Unit 8 p.48

Student A

Shanghai has the first commercial Maglev line in the world. Trains can reach 350 km/h in two minutes and have a maximum speed of 431 km/h in normal operation. Maglev (magnetic levitation) trains use a combination of magnetic attraction and magnetic repulsion to provide lift and forward movement and can operate on 10° gradients. They travel on raised guideways above the city which are very expensive to build, but track maintenance costs are significantly lower than with conventional rail transport. There is no engine and there are no wheels or rails as with conventional trains, so no friction. Maglev runs on electricity, producing no pollution from the vehicle. The speed and the distance between trains are automatically controlled and maintained by the frequency of the electric power fed to the guideway. Bad weather or congestion have little effect on the running of these vehicles.

Unit 12 p.89

Student A

The water-powered calculator runs on H2O batteries, so it needs no electricity or conventional batteries. The H2O battery consists of two electrodes made of special alloys. When these are immersed in water, a chemical reaction takes place which produces electricity. Over time, the water evaporates, and needs to be replaced. The batteries should last for over two years.

The eco-kettle allows you to boil only the amount of water you require. It has a double chamber. The inner reservoir holds a full capacity of water ready to be used. By pressing a valve button, the required amount of water is released into the outer boiling chamber. The level of water can be seen through the front window. This kettle is designed to reduce the excess amount of water people boil.

Unit 13 p.96

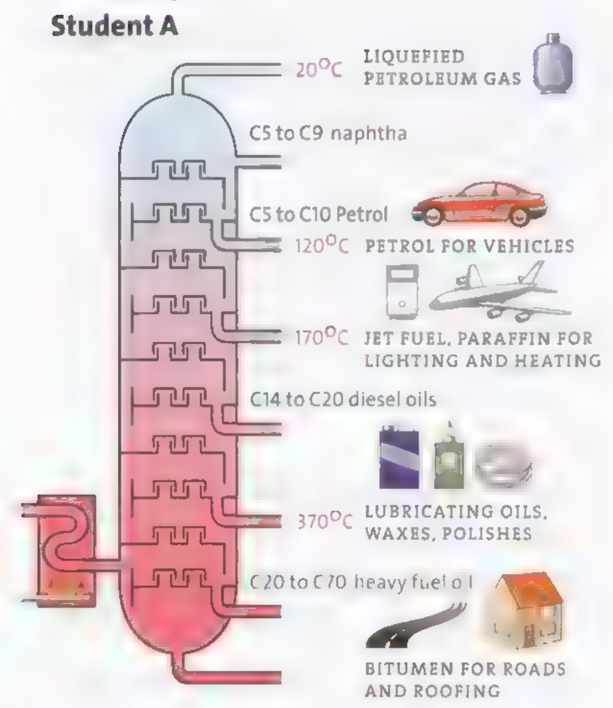
Student A

Silent Guardian

Raytheon, an American company, has developed a device which projects millimetre wave energy at a frequency of 94 GHz which it calls Silent Guardian. It heats the surface layer of skin causing protesters to move back quickly away from the pain source. It is effective up to 250 metres. It hurts but it does not kill. The waves only penetrate the surface layer of the skin, which is deep enough to cause pain, but not to injure, unless those targeted are exposed for more than four minutes. In practice, it is unlikely anyone would stay within range for so long, but the system also includes infrared scanners which check for any excessive skin heating. The system is intended for embassy protection, peacekeeping operations, and checkpoint security on sensitive installations such as nuclear power stations.

Unit 9 p.71

Student A



Unit 10 p.78

Student A

15 kilometres north of Shanghai lies the third largest island in China. The island is the location for a fully-sustainable eco-city called Dongtan.

The city is designed as small villages, each with its own character. This provides a community spirit, the base of Chinese society, so people walk and meet each other. The villages are connected by cycle routes, footpaths, and public transport corridors that use trams and buses. Solar-powered water taxis operate on the river. Zero-carbon public transport uses hydrogen-fuel technology or battery-power. Residential and business areas are mixed to reduce the need to commute. The buildings have been designed to be highly energy-efficient. They are angled to attract the maximum sun in winter and natural ventilation in summer. Local materials are being used with traditional and new construction technologies. Photovoltaic solar panel cells supply the buildings with energy. The city is self-sufficient in energy needs, using biomass from crops and rice residue as well as wind power from large wind turbines outside the city.

Unit 11 p.83 Speaking

Student B

B

Geminoid is a humanoid robot which looks and sounds just like his creator, Hiroshi Ishiguro of Osaka University in Japan. Its features are made from silicon moulds of his own body. It has the same hair colouring and style, and wears the same glasses and clothes.

Dr Ishiguro demonstrates his robot by using it to teach his classes. What makes this robot so convincing is that it appears to breathe, its eyes blink, and it fidgets just like a human. It also speaks with his voice. These effects are achieved by technology which includes 50 sensors and motors under Geminoid's skin to give expression to its face and to replicate human movements. The breathing effect is caused by compressed air forced into the chest. A motion capture system tracks the real Dr Ishiguro's mouth movements which are then copied by the robot. His voice is relayed through a speaker in the robot.

Dr Ishiguro believes that in future, humanoid robots will stand in for people who cannot be present at an event. We may have not only robot teachers, but robot politicians and singers.

Grammar reference

1 *-ing* form and *to* infinitive

-ing form

The *-ing* form is used directly after certain verbs.

These include: *admit, carry on, consider, delay, deny, enjoy, finish, give up, involve, keep (on), postpone, practise, resist, stop, suggest.*

Students should ***consider doing*** *a computer course*
The course ***involves learning*** *about the manipulation of digital images.*

The *-ing* form is also used after prepositions.

She ***succeeded in finding*** *a post as a Research Engineer.*

to infinitive

The *to* infinitive is used directly after certain verbs.

These include: *agree, aim, attempt, begin, choose, continue, decide, expect, fail, hope, intend, learn, manage, mean, offer, prepare, promise, propose, want.*

The planners ***agreed to make*** *the proposed changes.*

The Drillers ***managed to dig*** *a new well.*

Note that we can use the negative infinitive *not to.*

The company ***decided not to develop*** *the new system.*

Verbs followed by *-ing* form or *to* infinitive

There are several verbs that can be followed by either the *-ing* form or the *to* infinitive, with very little change in meaning.

These include: *begin, continue, hate, intend, like, love, prefer, start.*

We ***continued practising*** *our communication skills throughout the course.*
We ***continued to practise*** *our communication skills throughout the course.*

Note that we do not generally use two *-ing* forms together.

We are ***starting to learn*** *about database systems.*

NOT *We are ~~starting learning~~ about database systems.*

2 Past Simple v Present Perfect

Past Simple

We use the Past Simple to talk about an action that happened in the past. We often use time expressions such as: *last month, yesterday, 250 years ago, in 1850.*

Present Perfect Simple

We use the Present Perfect Simple to talk about an action that happened in a period of time up to the present.

Sometimes, no specific time is mentioned. This can indicate that something happened very recently, or that the time period stretches from any point in the past up to now.

The industry ***has announced*** *its profits.* (= recently)

The industry ***has been*** *at the forefront of new technology.* (= any time up to now)

We can use time expressions such as: *recently, this week, so far, over the last two years.*

So far this year the industry ***has not developed*** *any new techniques.*

Present Perfect Continuous

Positive

The landowner **has been planting** trees.

= subject + *have / has* + *been* + *-ing* form

Negative

We **haven't been using** the new equipment.

= subject + *have / has* + *not (haven't/hasn't been)* + *-ing* form

Questions

How **have** manufacturers **been improving** the design?

= (question word +) *have / has* + subject + *been* + *-ing* form

Like the Present Perfect Simple, the Present Perfect Continuous is used to talk about an action that carries on up to the present. Sometimes, we can use either tense without much difference in meaning, especially when we refer to a longer-term situation.

He ***has worked*** */* ***has been working*** *here for 20 years.*

In other cases, the Present Perfect Continuous emphasizes the fact that the action has continued up to the present and may not be finished. The Present Perfect Simple is often used to talk about quantity. Compare:

He's ***been planting*** *new trees.* (= he may or may not have finished)

He's ***planted*** *500 new trees.* (= he has finished planting the trees)

3 The Passive

Most bridges **are built** of concrete these days.

When cracks began to appear, the bridge **was strengthened**.

A number of construction methods **have been used**.

= subject + *be* (in correct tense) + past participle

We use the Passive to talk about processes and about how things are made and built.

Most tenses used in the Active can be used in the Passive.

The exception is the Present Perfect Continuous.
NOT *A new tunnel ~~has been being~~ built.*

We would use either:
Present Continuous Passive
*A new tunnel **is being built**.*

or

Present Perfect Passive
*A new tunnel **has been built**.*

Modals in the Passive

We can use *will* or modal verbs in the Passive.

*The tunnel **must be finished** on schedule.*

*The bridge **will not / won't be finished** on time.*

= subject + *will* / modal verb (+ *not*) + *be* + past participle

Modal verbs are commonly used in the Passive in official signs. Such notices in the workplace are often connected with issues of health and safety, and tell us what we must and mustn't do.

*Safety equipment **must be carried** at all times.*
*Any incidents **should be reported** to the site manager.*

by

Passive forms are used to avoid mentioning who performed an action. This is either because the agent is irrelevant to the process described or is unknown. Sometimes, however, we may want to use a Passive form and mention the agent. In this case, we introduce the agent with *by*.

*The cables are supported **by** twin towers.*

4 Ability and inability

There are several ways of talking about ability, possibility, and opportunity.

Ability / inability in the present

- *can / can't* + infinitive

*Bioplastics **can help** reduce the amount of waste we produce.*
*We **can't recycle** conventional plastic food wrapping.*

We use *can / can't* to express ability, possibility, and opportunity. This structure can be used in the Passive.

*Conventional plastic wrapping **can't be recycled**.*

- *is / am / are able to* + infinitive

We use *is / am / are able to* to express ability or opportunity. This structure is slightly more formal than *can / can't*. We use *is / am / are able to* rather than *can* after a modal verb.

*We **should be able to** reduce biowaste considerably by 2020.*

Ability / inability in the past

- *could / couldn't* + infinitive

could / couldn't are the Past Simple forms of *can / can't*.

*In the past, we **couldn't mould** plastic into complex shapes.*

- *was / were able to* + infinitive

was / were able to are the Past Simple forms of *is / am / are able to*. In many cases, *was / were able to* are used in exactly the same way as *could / couldn't*.

*In the past, we **weren't able to mould** plastic into complex shapes.*

However, when we want to talk about ability on an isolated occasion, rather than general ability, we can only use *was / were able to*.

*After doing a Google search, he **was able to find** the exact information he needed.*

Ability / inability in the future

- *will / won't be able to* + infinitive

*By using additives, **we will be able to** improve the properties of the plastic.*

However, note that it is very common to use *It will / won't be possible to* + infinitive instead.

*By using additives, **it will be possible to improve** the properties of the plastic.*

This is especially the case in the Passive, to avoid the awkward repetition of *be*.

***It will be possible to stop** chemical degradation.*
NOT *Chemical degradation ~~will be able to be stopped~~.*

- *can / can't* + infinitive

We can also use *can / can't* to talk about future ability or opportunity. This is less formal than *will / won't be able to*.

*We **can** talk to the Manager when he arrives.*

Note that we can't use *will can / will can't*.

NOT *We ~~will can~~ talk to the Manager ...*

5 Past Continuous v Past Simple

Past Continuous

Positive

Wave energy **was causing** several problems.

= subject + *was / were* + *-ing* form

Negative

The generator **wasn't running** very smoothly.

= subject + *was / were not* (*wasn't / weren't*) + *-ing* form

Questions

What equipment **was** the controller **using**?

= (question word +) *was / were* + subject + *-ing* form

We use the Past Continuous to talk about an action in progress in the past.

Past Simple

We use the Past Simple to talk about a completed action, or a series of completed actions in the past.

*The rotor **turned** against the wind and **started** the turbine.*

when / while / as

The Past Continuous and Past Simple are often used together when one action comes in the middle of a longer one. We can use time expressions such as *when*, *while*, or *as* before the longer action. Note the position of the comma.

***When / While** I was studying at university, I became interested in alternative energy.*

We can reverse the order of the two clauses. In this case, there is no comma.

*I became interested in alternative energy **when / while** I was studying at university.*

When can also go before the Past Simple.

*I was studying at university **when** I became interested in alternative energy.*

Note that *when* can introduce two Past Simple actions to describe an immediate consequence of an action.

***When** the computer activated the yaw motor, the rotor turned against the wind.*

On the other hand, *as* is used to describe two actions that happen simultaneously.

***As** the generator was turning, the turbine broke down.*

6 First and Second Conditionals

First Conditional

Form

if-clause	main clause
If I **finish** the course,	I **will earn** more.

= *If* + subject + Present Simple / subject + *will* + infinitive

Note that in the result clause we can use a modal verb, e.g. *may*, *might*, *can*, *could*, *should* instead of *will*.

*If the tests go well, the project **might** start ahead of schedule.*

Note the position of the comma in the above example.

The *if*-clause normally comes first, but it can come after the main clause. In this case, there is no comma.

The project might start ahead of schedule if the tests go well.

Use

We use the First Conditional to talk about a possible scenario or action and the probable result.

Second Conditional

Form

if-clause	main clause
If I **worked** as an area controller,	I **would earn** more money.

= *If* + subject + Past Simple / subject + *would* + infinitive

Note that we can also use *could* or *might* in the result clause.

*If I had a calculator, I **might / could / would** work this out more quickly.*

With the First Conditional, the order of the clauses can be reversed.

I might / could / would work this out more quickly if I had a calculator.

Use

We use the Second Conditional to talk about an imaginary situation and to speculate on the result.

unless

We use *unless* as an alternative way of expressing a condition. *Unless* replaces *if* in the *if*-clause, and is always followed by a positive verb. The result clause can either be positive or negative. Compare:

*If you **can't** take pressure, you won't be successful in this job.*
***Unless** you **can** take pressure, you won't be successful in this job.*

As with other conditional sentences, we can reverse the order of the clauses.

You won't be successful in this job unless you can take pressure.

7 Obligation and necessity

We use both *have* to and *must* to talk about obligation, but there are some differences.

have to

has / have to + infinitive can be used in other tenses, but not in continuous tenses.

Past Simple: *had to*

Present Perfect: *have had to*

Future: *will have to*

***I had / 've had to** obtain planning permission before building the extension.*
NOT *I ~~was having to~~ obtain planning permission.*

We use *has / have to* when we talk about something that we can or cannot do because of the circumstances, or because of a legal requirement.

*I can't come tomorrow because I **have to** go to a meeting with the planning department.* (= circumstances)

*All appliances **have to** be earthed.* (= legal requirement)

The question form is *Do / Does* + subject + *have to* + infinitive.

***Does** the extension **have to comply** with building regulations?*

don't have to

We use *don't / doesn't have to* + infinitive to talk about something that is not necessary. There is no sense of obligation.

*Your home **doesn't have to** have solar energy panels, but it would save you a lot of money on bills.*

*People **won't have to** worry about small rooms, as interior space will be more flexible.*

must / mustn't

We use *must / mustn't* + infinitive to talk about obligation. It has a similar meaning to the usage of *have to* for a legal requirement.

*All appliances **must** be earthed.*

We can also use *must / mustn't* to indicate personal authority.

*You **must** send me the plans by the end of this week.*
(= I am telling you to do this)

*You **have to** send me the plans by the end of the week.*
(= because of circumstances or a legal requirement)

Must / mustn't are only used in the Present Simple. Their forms never change.

*The new extension **must** comply with building regulations.*
*Fire exits **must** be accessible and **mustn't** be blocked.*

The question form is rarely used. Instead, we use *have to*.

***Does** the new extension **have to** comply with building regulations?*

Similarly, if we want to talk about obligation in the past or future, we use the appropriate form of *have to*.

*In some countries, any new buildings **must** be less than three storeys. But by 2020 all buildings **will have to** be earthquake resistant.*

8 Comparative and superlative review

We use comparative and superlative adjectives to talk about the differences between two or more things.

We use comparative adjectives to make a comparison between two things or situations.

Form	Adjective	Comparative	Superlative
One-syllable adjectives	fast	Add **-er** faster	Add **the** + **-est** **the** fast**est**
One-syllable adjectives ending in -e	wide	Add **-r** wide**r**	Add **the** + **-st** **the** wide**st**
Two-syllable adjectives ending in **-y**	happy	Change -**y** to **-ier** happ**ier**	change **-y** to **-iest** happ**iest**
Adjectives with two or more syllables	efficient	**more** + adjective **more** efficient	**the** + **most** + adjective **the most** efficient
Irregular adjectives	good bad far	better worse farther/ further	the best the worst the farthest/ furthest

Comparative adjectives

Use

When we compare two things or situations directly, we use the comparative + *than*.

I find journeys by plane a lot ***more tiring than*** *journeys by ship.*

The opposite of *more* is *less*. We use *less* with adjectives with two or more syllables.

Air travel is ***less expensive than*** *it used to be.*

To make a comparison stronger, there are several adverbs that we can use before the comparative.

The ones that emphasize large differences include: *much, far, considerably, substantially, a lot, a good / great deal*. Those that emphasize small differences include: *slightly, a little, rather, somewhat*, and, more informally, *a bit*.

Maglev trains move passengers at a ***much lower*** *cost compared to ships.*
Passengers are ***somewhat less concerned*** *with train décor than with speed.*

Note that we can use *really* or *absolutely* to make an adjective stronger but we cannot use these before a comparative.

NOT *Maglev trains move passengers at a ~~really lower cost~~ ..*

We also use adverb + comparative structure before a noun, e.g. *a lower cost, a better way, more speed, less fuel, a much higher profit, a far less efficient system*

Superlative adjectives

Use

We use superlative adjectives to make a comparison between more than two things.

The opposite of *the most* is *the least*. We use *the least* with adjectives containing two or more syllables.

I think that the Maglev is the ***least stressful*** *way to travel.*

We also use adverb + superlative structure before a noun, e.g. *the fastest method, the most interesting journey, the worst aspect, the least expensive option.*

9 Present tense review

Present Simple

Use

We use the Present Simple with:

- facts and things that are generally true.

Production platforms ***stay*** *in place for as long as the field is productive.*

- routines, especially with adverbs of frequency.

I ***come back*** *to the rig every few weeks.*

- verbs that describe thinking and feeling, e.g. *feel, look, smell, sound, taste.*

Crude oil ***feels*** *sticky.*

Present Continuous

Use

We use the Present Continuous to talk about:

- something that is happening at the time of speaking.

We're ***having*** *a fire drill.*

- something that is happening around now, although not necessarily at the time of speaking. We generally do not expect the action to continue for a long time.

*I'm **supervising** a new Driller this week.*

Note that with a continuous tense, such as the Present Continuous, we do not generally use non-action verbs such as: *be, believe, cost, feel, forget, hate, have, hear, know, like, mean, remember, smell, taste, understand, want.*

NOT *I'~~m not knowing~~ these figures.*

There are exceptions to this when these verbs are used in an active sense. For example:

***I think** this is the best option.* (= this is my opinion)
***I am thinking** about the possibilities.* (= I am actively using my mind)

10 Reported speech

Reported statements

When we report a statement, we commonly use the Past Simple of the reporting verbs *say* and *tell*.

*Mr Bran **said** (that) we would have to change the filters.*

Note that the pronoun *that* is not essential.

Told must always be followed by an object (*me / us / the shareholders*, etc.).

*Mr Bran **told us** (that) we would have to change the filters.*

We can also use other reporting verbs such as: *admit, announce, confirm, explain, recommend, suggest, warn.*

*The director **announced** that our design team had won an award.*

Direct and reported speech

When we change direct speech into reported speech, there are several changes that need to be made.

- The tense of the original verb:

Direct speech:	*'I generally spray the paint in a ventilated closed room,' said the engineer.*
Reported speech:	*The engineer said (that) he generally sprayed the paint in a ventilated closed room.*

Note that in this case, we could keep the Present Simple form *sprays* in reported speech, if we want to emphasize a current routine.

In general, however, the original verb changes as follows:

Direct speech		Reported speech
Present Simple	→	Past Simple
Present Continuous	→	Past Continuous
Past Simple	→	Past Perfect
Present Perfect	→	Past Perfect
Modals: *will*	→	*would*
can	→	*could*
may	→	*might*
must	→	*had to*

- Pronouns:

Direct speech:	*Ms Symons: 'Designing engineering systems gives me great satisfaction'.*
Reported speech:	*Ms Symons said that designing engineering systems gave her great satisfaction.*

- Time expressions:

Direct speech	Reported speech
today	that day
yesterday	the previous day
this week / month / year	that week / month /year
(the) next week / month / year	the following week / month / year

*'The resulting sludge was disposed of **yesterday**.'*
*She said the resulting sludge had been disposed of **the previous day**.*

Reported questions

When we report questions, we use the verb *ask* + object instead of *say* or *tell*. In a reported question, the word order is the same as in a positive sentence.

- ***Wh-*** **questions**

Direct speech:	*'How do you dispose of the waste paint?' the inspector asked us.*
Reported speech:	*The inspector asked us how we disposed of the waste paint.*

- ***Yes / No*** **questions**

If a question does not begin with a question word such as *What?* or *How?*, we begin the reported question with *if*.

Direct speech: *The Inspector: 'Do you add chlorine to the water?'*
Reported speech: *The Inspector asked if we added chlorine to the water.*

Reported orders and instructions

When reporting an order or instruction, we can use the past tense of the reporting verbs *tell / ask* + object + (*not*) *to* + infinitive:

Direct speech: *'**Check** the water pressure in the pipes.'*
Reported speech: *He **told / asked** Keith **to check** the water pressure in the pipes.*
Direct speech: *'**Don't forget** to check the water levels, John.'*
Reported speech: *He **told / asked** John not to forget **to check** the water levels.*

11 Causing, preventing, and enabling links: *cause to, make, prevent, stop, allow to, enable to, let*

There are several ways to describe the relationship between actions.

Causing

cause + object + *to* + infinitive

make + object + infinitive

*Vibration or pressure can **cause a mine to explode**.*
*Vibration or pressure can **make a mine explode**.*

Preventing

prevent + object + *from* + *-ing* form

stop + object + *-ing* form

*The hard ground often **prevents the robot from uncovering** mines.*
*The hard ground often **stops the robot uncovering** mines.*

Enabling

allow / enable + object + *to* + infinitive

let + object + infinitive

*Digital cameras **allow / enable** the robot to navigate by itself.*
*Digital cameras **let** the robot navigate by itself.*

Sentence structure

There are two ways we can structure these ideas.

- Relative clause, using *which* + verb of causing / preventing / enabling

*Batteries run down quite quickly, **which** causes the robot to stop moving.*
*The Mars Rover is fitted with digital cameras, **which** prevents it from colliding with obstacles.*
*The robot is equipped with sensors that measure pressure, **which** enables it to handle delicate items.*

Note that the verb following *which* is in the third person singular, as it refers to the preceding action rather than to a singular or plural noun.

- Omitting *which* and using the *-ing* form of the verb that follows it. Compare:

*The robot has six legs, **which enables** it to walk delicately through mine fields.*
*The robot has six legs, **enabling** it to walk delicately through mine fields.*

12 Question review

There are two main types of question: those which require a *yes / no* answer, and *wh*-questions, which ask for specific information.

Yes / No questions

These begin with an auxiliary verb, such as *Do, Am / Is / Are, Have / Has, Can, Could, Will, Must, Was / Were, Did*, etc.

auxiliary + subject + main verb

Can solid wood be used for carcasses?
Will marble worktops be more expensive than granite?
Was melamine coated chipboard used?

Wh-questions

These begin with question words such as: *What, Who, When, Where, Why, Which*, and *How*. We can use *How* in other combinations such as: *How much, How many, How long, How far, How safe*, etc.

The question words *What, Which, How much, How many* can be followed by a noun.

Question word / question word and object + auxiliary + subject + main verb

*What **does** a CNC cutter **do**?*
*How many eco-kettles **has** the company **made** so far?*

In the two sentences above, the question word is the object of the main verb. Note that *What, Who, Which, How much, How many* can also be the subject of a question. In this case, the word order is the same as in a positive sentence.
Question word / question word and subject + verb

***What types** of door are available?*
***How much** experience has he got in designing kitchens?*
***Who** invented the microwave oven?*

Requests

We make requests by using a polite question form. For requesting information, these include:
Could you tell me ... ?
I'd like to know ...

Note that these are followed by:

- Question word + positive word order, for *wh-* questions:

***Could you tell me** how the router works?*

- *If / Whether* + positive word order, for *yes / no* questions:

*Could you tell me **if / whether** solid wood can be used for carcasses?*
NOT ~~*Could you tell me how does the router work*~~*?*
~~*Could you tell me can solid wood be used for solid carcasses*~~*?*

Other structures used to make requests are:
I'd like you to + infinitive

I wonder if you could + infinitive

Would you mind + *-ing* form

***I'd like you to send** me a catalogue, please.* (no question mark needed)
***I wonder if you could help** me?*
***Would you mind giving** me a demonstration?*

Generally, we reply to requests by saying *Certainly* or (*Yes*) **of course**. However, it is common to respond to a request beginning *Would you mind* with *No, of course not.*

Note that the structure *I wonder if you could help me?* precedes a more specific request, especially one that may be quite complicated. Alternatively, *I wonder if you could* + infinitive can be used as a request on its own.

***I wonder if you could help me?** I'm interested in finding out more about your kitchen design service?*
***I wonder if you could send** me a catalogue, please?*

13 Prepositions review

There are many prepositions that we can use to talk about time, place, and movement. Some prepositions can belong to more than one category.

Prepositions of place and movement

Many prepositions of place can also describe movement, depending on the verb used. For example:

Place: *The multi-purpose gun **is under** a special cover.*
Movement: *The multi-purpose gun **is placed under** a special cover when not in use.*

Other examples are: *above, across, opposite, over.*

The common prepositions *in* and *on* generally express position. To express movement, we use *into* and *onto*.
*The army moved **into** the town.*

The preposition *at* is only used to express position, while *to* expresses movement.

In, at, and *on* have the following usages:

in enclosed spaces, e.g. rooms, buildings, vehicles, equipment
*There's a fault **in** the drive.*

in expressions such as *in front of*
*The microphone is **in front of** the robot so that it can pick up sounds immediately.*

on surfaces
*The amphibious personnel carrier is adapted for movement **on** land and **on** water.*

in expressions such as *on the left / right (of), on (the) top / back / side / front (of)*

*The camera is positioned **on top of** the mast, not halfway down it.*

at general location when it is not important exactly where something is
***at** the airport*
***at** the centre (of)*

in expressions such as *at the end / side / back / top (of)* – these give a much less specific indication of position than expressions such as *on the side of*

*There is an additional piece of equipment **at the side of** the robot.* (= but not necessarily attached to the robot)

There are many other prepositions of place and movement. We use *next to / beside* and *close to / near to* to talk about how close things or people are. However, *next to / beside* mean that one thing or person is at the side of another, while *near / close to* tell us only that one thing or person is not far away from another.

A *Is the folding boom* ***next to / beside*** *the mast?*
B *No, but it is* ***very near / close to*** *it.*

(not) far from is another expression used to talk about general proximity.

between means to have someone or something on each side.
Unmanned scout vehicles will patrol ***between*** *frontline soldiers and the enemy.*

opposite means that one thing or person is facing another.
The caterpillar tracks are on ***opposite*** *sides of the robot.*

Prepositions of time

The prepositions *in*, *at*, and *on* are also used to talk about time.

in parts of days, months, seasons, years: ***in*** *the morning*, ***in*** *March*, ***in*** *2007*
to say how soon something is going to happen: *The test will start* ***in*** *two hours.*

at times of the day, mealtimes: ***at*** *8 a.m.*, ***at*** *breakfast*, ***at*** *night*, ***at*** *Easter*

on days of the week, special days, dates: ***on*** *Sunday*, ***on*** *my birthday*, ***on*** *4 May*

Other prepositions of time include:

for to talk about how long something will last: *It will last* ***for*** *two days.*

until meaning up to a specific point or before a particular action takes place: *until 17.00*, ***until*** *the machine is proved in action*

Other prepositions

There are many prepositions that are not used to describe place, movement, or time. Common examples include: *with*, *without*, *by*, *as*, *about*, *of*, and *for*.

These are often used after certain verbs, adjectives, or nouns.
an advantage over, consists of, depends on, equipped with, filled with, known as.

14 Complex sentences

There are several structures we can use in order to link ideas within a sentence.

when, as, until

We use these time expressions to show clearly the order in which different events happened. The part of the sentence that begins with the time expression is called the time clause.

when

We use *when* to refer to actions that happen at almost the same time. One action is an immediate consequence of another. Note that when the time clause comes first, it must be followed by a comma.

When *the voltage rises, the relay is activated.*

We can change the two parts of the sentence around, but *when* must always come before the first action in the sequence of events.

The relay is activated ***when the voltage rises.***

When the time clause comes later in the sentence, we do not use a comma to separate the two clauses.

as

We use *as* to talk about two actions that happen at the same time. The position of the time clause can change, in the same way as for *when*.

As *the temperature falls, the resistance of R1 rises.*
The resistance of R1 rises ***as*** *the temperature falls.*

until

We use the preposition of time *until* to mean 'up to a certain point'.

The relay doesn't operate ***until*** *the trigger temperature is reached.*

if-clause

We can also use an *if*-clause to link cause and effect.

The *if*-clause normally comes first, but it can come after the main clause. In which case, there is no comma.

The transistor will overheat if excess current is passed.

Relative clauses

In relative clauses, we use the relative pronouns *who* when the subject is a person, or *which* when the subject is an object.

We can use a relative clause in two ways:

- to make a definition (defining relative clause)

This is the battery ***which*** *provides a high current.*
(= there are other batteries, but this one provides a high current)

He is the person at Bell Laboratories ***who*** *pioneered the new technique.* (= there were several people at Bell Laboratories, but he pioneered the new technique)

- to add information (non-defining relative clause)

This is a new type of battery, ***which*** *can provide a higher current than standard ones.*
That is Mr Hodgson, ***who*** *pioneered the new technique.*

Note that in this type of relative clause we use a comma before *who* or *which*.

-ing form

When we talk about a process that causes, prevents, or permits another action, we can use the *-ing* form to replace *which* and the verb that follows it. Compare:

This completes a circuit, ***which generates*** *a series of pulses.* (non-defining relative clause)
This completes a circuit, ***generating*** *a series of pulses.*

15 Future review

There are several ways to talk about future events or situations.

will / won't + infinitive

We use *will* to talk about what we know or think we know about the future, including making predictions. We do not use *will / won't* to talk about intentions.

The course ***won't*** *last longer than about four months.*

When we are uncertain about the likely outcome of a situation, it is common to use *will* in combination with verbs such as *think*, *know*, or *expect*.

I ***think / know / expect*** *(that) the training will be difficult.*

Note that we do not tend to use the positive form of *think* with *won't*. Instead, we use *don't /doesn't think* + positive verb.

I don't think the course will be very interesting.
NOT ~~*I think the course won't be very interesting*~~.

We can also use adverbs such as *definitely* or *probably* to sound more or less certain about the future.

It'll ***probably*** *take two hours to fix.*
I'll ***definitely*** *get there before five o'clock.*

Another use of *will / won't* is when we decide to do something at that particular moment, e.g. in order to promise or offer to do something, and to make requests.

A *I've got to go out in a few minutes so I can't meet the supplier.*
B *OK,* ***I'll*** *meet him.*

going to + infinitive

We use *going to* + infinitive without *to* when we talk about our intentions. We have already decided what to do

I'm ***going to meet*** *the supplier.*
She's ***going to apply*** *for a new job.*

We also use *going to* to make predictions about the future based on present evidence.

Look at those big grey clouds. It's ***going to rain****.*

Present Continuous

We use the Present Continuous to talk about a pre-arranged event, but not one that is part of a regular programme or timetable.

I'm ***moving*** *to a new department.*

It is very common to use a time expression with the Present Continuous when talking about the future so that it is not confused with something that is happening now. Compare:

Present:	*He's* ***attending*** *the conference.*
Future:	*He's* ***attending*** *the conference* ***on Thursday****.*

Listening scripts

Unit 1

It's my job

When I left school, I started work for a plastics company, one of the biggest in the country. We make everything from small components for medical equipment to large water pipes – the blue ones which are replacing metal pipes everywhere.

My apprenticeship lasts for three years. I'm in my final year now. It's a good mix of work, which I get paid for, of course, on-the-job training, and study at the local college

I've learned a lot of practical skills from the on-the-job training. It's supervised by skilled workers. There's quite a lot of paperwork as I have to complete forms to show I've reached the right standard

I had day release to attend college one day a week in the first two years of my apprenticeship and I've got two days a week in my last year. I've learned things like working in teams, problem-solving, communication skills, and using new technologies at work, as well as engineering subjects. This year I'm completing an HNC, a Higher National Certificate, in Engineering

I like learning while working, but it's quite hard work. There's a lot of studying to do – at home in the evenings and at weekends too. I'm doing about ten hours a week right now. It's quite hard when your friends are out having a good time.

Once I'm fully qualified and have a bit more experience, I hope to get promoted to team leader That means I'll be in charge of a team of six – more responsibility and better pay

Pronunciation – Unstressed syllables

transmission	development
performance	maintenance
propeller	specialist
electricity	qualification
installation	medicine
regulation	environment

Unit 2

Listening – Precision agriculture

B = Barry, S= Student

B As you know, when farmers grow crops, they use machines for ploughing and harvesting as well as chemicals, such as fertilizers and weed killers. Traditionally farmers have sprayed chemicals uniformly across the field so the same amount of fertilizer or pesticide is sprayed in each part of the field whether it was needed or not. But, of course, not all fields are the same. One end of a field may have lots of weeds, but the other end may have none at all. Or one area could need more fertilizer than another. So, spraying the field uniformly is really a waste of resources

But by including IT in modern farm machinery we have been able to make farming far more efficient. Farmers can gather precise information about their fields and the computer can control the farming equipment allowing the correct amount of chemical to be applied. This is an example of precision agriculture.

S How does the farmer get the information?

B Well, there are two ways of gathering information about a field. One way is to use satellites or planes. These can then produce soil maps. Using these maps, the farmer can see on the computer what needs to be done. This method is quite cheap and very reliable but the drawback is that it's not very exact – it can be difficult to distinguish closely-related features in these maps. The other way of collecting information is using sensors mounted on a tractor. As the farmer drives across his field, information is fed into his onboard computer and this controls the amount of chemicals being applied. Because the tractor-mounted sensors are closer to the ground than the satellite technology, they can provide more detailed information. But this system costs more because the IT equipment has to be very responsive and make very fine adjustments quickly

On the farms which now use this technology, there have been fantastic savings. With this precision equipment, farmers are able to use 50% less herbicides and fertilizers than before and, of course, that's a big saving and better for the environment

Make your point – Beginning a presentation

Giving a presentation can make me very nervous, but I find that if I'm well prepared, I feel more confident. There are four things I ask myself before I even start. First of all, who am I going to talk to and what do they already know? Secondly, where am I speaking? What facilities are there? I have to consider the equipment, for example if I want to use PowerPoint, is there a screen? Thirdly, what is the purpose of my presentation? Do I want to inform, impress, or persuade the audience, or do I want to sell a product? And finally, how much time will I have?

The answers to these four questions have an important effect on what I include in my presentation and how I make it. I usually put ideas down on a piece of paper and then try to group these ideas under headings. Then I make some short notes on small cards that I can hold comfortably in my hand and use during my presentation. I like to use PowerPoint for my presentations, so I start preparing slides. I collect all the pictures, diagrams, photos that I want to use and put them in the correct order. Once I feel that I've got things well organized, I prepare the introduction.

Even if my audience know me, I still introduce myself and explain my position. I begin by saying, 'Most of you know who I am. I'm Lee Avatar and I'm responsible for training and communications'. Then I explain what I'm going to talk about, and in what order I mention that I'll be using PowerPoint. I usually invite people to interrupt me if they have any questions during my talk, but sometimes I ask the audience to keep questions 'til the end. I give an outline of the main points in my first slide, and I find it's a good idea to tell the audience what handouts I am going to give them so that they can concentrate on what I'm saying instead of writing notes

Unit 3

Listening – The Great Belt East Bridge

The Great Belt East Bridge is part of a link between Denmark and Sweden. The first design was made in 1965. It consisted of a box girder bridge with two central spans, each 400m in length. These were supported by piers. The idea was that ships sailing in one direction would pass under one span, and those sailing in the other direction would use the other span.

Because ships became larger and larger, this design was abandoned and a new design made in 1973. This had a much wider central span of 780m. This is greater than the limit for box girder bridges – around 500m. At this point even the strongest steel bends under its own weight. So a cable stay bridge was proposed. With cable stay bridges, the decks are built out from each pier until they meet in the middle. The longer the bridge, the more difficult it is to control the movement of the ends when it is windy – 1,000m is about the limit for such bridges.

Construction was further delayed and in the meantime ships grew larger than ever. Experiments showed that large ships could not safely pass each other under the bridge – even with the wider span. The risk of collision was too great. The only alternative was a suspension bridge. A new design was made in 1993 for a suspension bridge with a 1,600m span – at that time the longest bridge in the world. To support such a span, two huge towers, each 254m high, were built. The bridge deck is quite slender – only four metres deep. To prevent twisting in the wind, the deck was specially shaped. The suspension bridge was finally completed in 1998

Unit 4

Listening – The history and properties of plastics

A = Antonia, F = Fatima

A I think that this assignment on the history and properties of plastics should be quite interesting.

F Yeah, I'm looking at the British Plastics Federation website, that's www.bpf.co.uk, it's got some good stuff about the history of plastics. You know plastics can be used to produce almost anything nowadays.

A Yes. Just look at your toothbrush, these files, the table lamp, the street lights outside, even the white lines on the road, they're all made of plastic.

F It says here that the first plastic was made of cellulose in the mid-eighteen hundreds and was used to make billiard balls! That was a great step forward in the world of science. Apparently, people were worried that there weren't enough elephants to provide ivory for making billiard balls so they had to find a substitute. The first balls were made of coated celluloid

A Celluloid is the plastic made from cellulose, isn't it?

F Yes, and cellulose comes from plants. The problem was that this can be explosive. The inventor liked to tell stories of the early balls exploding when they were hit hard! Imagine that!

A I found a book in the college library called *Plastics*, and it says that another problem with the early plastics such as celluloid was that you couldn't make things to a high standard of quality. Apparently, it wasn't until they started using petroleum and natural gas in the mid nineteen hundreds that plastics production was really able to take off!

F Yes, it says here that using petroleum and natural gas led to the development of so many different plastics: polyethylene, nylon, polyester, and they've all got different properties so you can always find one that's suitable for your product.

A Exactly! They're really versatile. Today, the plastics industry is mainly based on oil so we can produce household and industrial items cheaply. But we are running out of oil, what are we going to do then?

F Recycle! On this website, www.chemsoc.org there are loads of facts about plastics. Today, manufacturers have the technology to produce things such as rubbish bins, plastic sacks, and even clothes from recycled plastic and I'm sure we'll be able to extend this range of goods soon. I'm sure we'll be recycling large quantities of plastic in the future. But we'll have to find good systems for collecting plastic for recycling. That's not very effective at the moment.

A We'll also have to find alternative raw materials for producing new plastic. There are already new technologies available which allow us to use other raw materials.

F Yeah, look! I've just found in www.worldcentric.org that companies are now able to make bioplastics from the starch in wheat, and even oranges! Some manufacturers are already producing things like food wrapping from these bioplastics.

A I think they are still expensive to produce, so more research will have to be done to allow us to produce these plastics more cheaply. But I'm sure that these will be important for the future for plastics.

Make your point – Describing a pie chart

I'd like to show you a pie chart which represents the use of plastics by sector. If we take a look, we can see that the largest sector which uses plastic is the packaging industry. You will notice that over a third of all plastics are used here.

As you can see, the building and construction sector is the second biggest, using 23 per cent. You will notice that together with packaging, more than half of all plastics consumption is in these two sectors. Take a look at the electrical and electronics industry, which consumes eight per cent, and you will see that the same figure applies to the furniture and houseware sector, as well as the transport sector. Agriculture accounts for slightly less plastics consumption, seven per cent

At the opposite end of the scale from packaging, you can see that the smallest sector is the footwear sector, using only one per cent. Both the medical and mechanical engineering sectors use slightly more plastic than footwear – two per cent, while the toys and sports sector accounts for one per cent more than this.

Pronunciation – Disappearing sounds and word linking

1

1 This is a thermoset plastic.
This is a thermoset application.
2 It's used in household items.
It's used in household products.
3 One process is blow moulding.
It's used to make hollow items.
4 It meets safety standards.
They must use safety equipment.
5 It's a softer material.
It's a softer option.

2

a Light stabilizers prevent light damage.
b Plasticizers are used to make plastics softer
c Even the street lights are made of plastic.
d Plastics production was really able to take off
e Polyester fibres are used a great deal in clothing

Unit 5

Listening – Wave Energy Innovator

I = Interviewer, R = Richard Yemm

I Richard is Managing Director of Ocean Power Delivery Ltd. His company makes wave energy converters. They supplied converters for the world's first commercial wave farm five kilometres off the coast of northern Portugal. When complete, it will generate 22.5 megawatts from wave power
Richard, how did you get into wave energy?

R I discovered wave energy when I was doing my PhD at Edinburgh University. I was working next door to Stephen Salter, the grandfather of wave energy [illegible]
[illegible]
when a project came up a few people said to me [illegible] put your money where your mouth is

At the end of the day, there's no point just making clever things. They have to have an application in the modern world. I'm environmentally aware, I recycle my rubbish and all that, but goodwill alone doesn't get it done. Our object is to earn revenue for people and in so doing, come up with an energy that reduces carbon emissions. It's only going to be achieved if we make it commercially viable

I What about the name, where did that come from?

R We weren't going to give the project a name We were sick of all the silly biological names that people kept using for wave converters, such as Duck and Frog. We were just going to call it the OPD750. But then a journalist threatened to call it the Whiplash, so we did a quick Google search on sea snakes, because that is what it looks like, and found Pelamis, a sea snake that swims only on the surface. And we liked that.

Unit 6

Make your point – Making telephone calls

R = Receptionist, B = Francis Ball

R Guten Tag! Abat GmbH

B Hello My name is Francis Ball. I'd like to speak to Mr Braun, please.

R I'm afraid Mr Braun isn't available at the moment. Can I take a message?

B Could you ask him to send the range in nautical miles for the MD-11F? That's the McDonnell Douglas freighter plane. I have the range for the MD-11, the passenger plane – that's six thousand, eight hundred and forty Could you ask him to call me later today? I'll be out till four.

R What's your number, please?

B I'm in the USA so it's 001 (double oh one) 246 639 0001 .

R That's fine. Thanks for calling.

M = Michael Braun

B Hello

M Hello, Michael Braun here.

B Hello, Michael. Thanks for getting back to me

M I'm sorry to call you on your mobile but there was a problem with the phone number you left. What range do you have?

B The MD-11 – the passenger plane range

M The passenger plane. Oh, I see. What is it?

B Six thousand, eight hundred and forty.

M Did you say six thousand, eight hundred and forty? So, you need the freighter plane range.

B That's right.

M I think the freighter plane is about half that, but I'll get back to you.

B Thanks But, I won't be in the office for the next three days. Could you give the range to my colleague, Ivor Teslenko?

M Could you spell that for me, please?

B That's IVOR TESLENKO

M TESLENKO?

B That's right. His number is the same as mine but with 0053 at the end. So it's, 001 246 639 0053.

M Sorry, I didn't catch that.

B It's 001 246 639 0053

M So, 001 246 639 0053. OK, I've got that.

B I'll speak to you next week. Thanks for calling.

Unit 7

Listening – Earth homes

I = Interviewer, P = Peter Carpenter

I What is an earth home?

P An earth home is any house which is built in part underground. Often earth houses are built into a hillside with earth on three sides and on the roof, in the northern hemisphere, we usually build them with the fourth side facing south to obtain the maximum light and heat

I What are the advantages?

P Forget any idea that earth houses are cold, dark, and damp. That's a cellar, not an earth house. Earth homes are well-insulated. They're warm in winter and cool in summer. They're durable too. They're less exposed to the elements and can last for hundreds of years. Another big plus is that they make much less impact on the environment. They're less visible than ordinary homes so the landscape isn't spoilt and energy costs are very low. They're very low-maintenance You don't have to paint them. You don't have to worry about roof repairs.

I What are the technical issues in building them?

P First of all, you can't build an earth house just anywhere. You must have planning permission, even though it's underground. The commonest construction method is to excavate a hillside and build a structure into the hill. The roof has to be strong enough to bear the weight of soil on top and the walls must support the roof and resist the pressure of earth around the building so concrete, bricks, and masonry are often used Waterproofing is important. You have to prevent moisture seeping into the structure from the walls and roof and through the floor. Lighting and ventilation are also important. You can include roof panels to introduce natural light to all parts of the building and to permit ventilation
Earth houses are usually very well insulated. The soil cover reduces any seasonal variation in temperature and in construction the whole building is lined with insulating materials so there's very little heat loss in winter. In summer, there's considerable heat gain through the south-facing windows.

Unit 8

Pronunciation – Showing enthusiasm

1 The story of the Airbus A380 is really fascinating.

2 When you stand near it, you realize it's absolutely enormous.

It's my job

I = Interviewer, M = Matt Haydon

I What's your job?

M I'm a Marine Engineer. Currently, I'm Second Engineer working on a passenger cruise ship

I What are you responsible for in your job?

M Well, I'm in charge of everything on the ship which is mechanical, electrical, or structural The Engineer's job is to keep everything working. That can be toilets, computers, doors, a crankshaft, whatever! If there's a problem with a piece of equipment, we have to decide if it has to be fixed or if we can manage without it for a while. We repair it, if possible, but sometimes we have to call in specialists.

I So, what sort of training did you have to become a Marine Engineer?

M Well I trained as a Marine Engineer Apprentice. I worked for a shipping company who sent me to college for four months a year. Once I had passed all the exams, I got my licence, which is issued by the government. Training is different now. Most Engineers have a degree in Engineering, usually Mechanical engineering. But they still have to get a licence to work on board ship.

I What's the most challenging part of the job?

M I suppose it's being with other people all the time You have to learn to trust and respect others

I Are there any risks?

M There certainly are! The sea is an unpredictable place to be. The ship is constantly moving and large machines have large parts that are moving fast. There's fuel that could easily ignite, chemicals that are dangerous, and also electromagnetic rays.

I How much time do you get off?

M Well, officers normally get one day off for each day worked. At the moment I'm on fourteen weeks, and I'm getting fourteen weeks off after that. It sounds a lot, but don't forget, when you're at work, you're away from your home and family.

I What hours do you work on the ship?

M Well, there are always two officers in charge of operations on the ship. One is called the Navigation Officer of the Watch – the NOW. He works on the bridge. Then, there's the Engineering Officer of the Watch – the EOW. That's me. I work in the control room monitoring the engines and ship's systems – fuel, temperature, water pressure, and so on. I do an eight-hour shift and then another three to four hours carrying out routine maintenance

I Would you recommend this job to others?

M Of course, but you have to be tough. You have to be fit. There are lots of stairs to be climbed and small spaces to crawl into! There are lots of unknowns and upsets but you gain satisfaction and pride from working in a very challenging environment. But, it's still a man's job, there are very few women!

Make your point – Persuasion

J = Jo Illich, M = Man in the audience

J These traffic figures were collected two months ago on the main roads entering the city. As you can see, traffic congestion has increased considerably. It is my opinion that a six-lane motorway around the city would be an appropriate way to solve the problem. I'd like you to take a look at this map where I have outlined the proposed route. The main reason for choosing a motorway bypass is that most of the traffic, in fact, passes through our city en-route for Largetown 25 km to the south-east. We estimate that a motorway would reduce the traffic in the city centre by as much as 57%.

M How did you arrive at that figure?

J This was calculated from the traffic statistics and a computer model. I have details of the calculations to show you. I have also prepared a detailed costing of the project which I'd like to give you now. Could you pass these round, please? Thank you.

Unit 9

It's my job

I = Interviewer, M = Michael Lennon

I How did you get started in the oil industry?

M I left school at 16 and took a course in car maintenance at the local technical college. I finished the course, but being a motor mechanic wasn't the right career for me. I wanted something more adventurous so I got a job as a Roustabout on a North Sea rig

I What's a Roustabout?

M It's about the lowest job you can get. A Roustabout is a labourer. You get jobs like painting and unloading supplies from the supply ships. Still, the money was good and the food was good too – hotel standard. Food's important when you're living on a rig in the middle of the sea in all kinds of weather for fourteen days at a time without a break.
After a year I was promoted to Roughneck.

I What does a Roughneck do?

M That's a skilled job. You need physical strength but you also need to know exactly what to do at any time. Often you're working with heavy drill pipes – adding pipes when you're drilling or removing pipes when you're breaking out the string

I Breaking out?

M Removing the string of pipes from the borehole. You're part of a team and you need to know exactly what you're doing at any time to get the job done quickly and safely. Safety's an important issue on the rigs. Before I could start on the rig, I had to take a course on Off-shore safety and survival at Montrose College. They teach you all sorts of things, including how to escape from a helicopter just in case you come down in the sea.
I did quite well as a Roughneck and after a couple of years I was selected to do a diploma in Off-shore drilling at a drilling school in Aberdeen. There were people there from all round the world – Nigeria, Oman, Vietnam. It was a good course. They had a rig floor simulator so you got practice in dealing with situations such as blow outs.

I These can be dangerous.

M Yes, that's when you hit oil under high pressure and it's forced up through the borehole. And fishing – recovering from the borehole drill bits and tools which have become separated from the pipe.

I What did you do after the course?

M When I finished the course, I was qualified as an Assistant Driller. I worked on a North Sea rig for three years more then I moved to a warmer part of the world, the Gulf of Mexico, as a Driller with Texaco. I'm still working there but I'm married now with a family. I like the work but I'm hoping to get a shore-based job as a Drilling Superintendent.

Pronunciation – *be* with the Present Continuous

1

1 I'm looking for my goggles.
2 You're standing too close.
3 He's not wearing a helmet.
4 We're having a fire drill.
5 They're learning first aid.

3

1 We're studying to be Petroleum Engineers.
2 She's taking a safety course.
3 I'm working for a Dutch company at the moment
4 They're planning to shut down the well.
5 You're not following the instructions properly.
6 Who's looking after this site?

Unit 10

Vocabulary – Reporting verbs

A What's happening at the water plant? Have you had time to look at the problem?

B Yes. I went up to the reservoir earlier today and there seemed to be a problem with the pipe from there to the microstrainer.

A Was it blocked?

B It was partially blocked.

A Why had that happened?

B I think it must have been due to the heavy rain on Monday which washed a lot of debris into the reservoir.

A It'll have to be cleared quickly.

B I know We're working on it at the moment.

A Once you've done that, you need to finish the report on the proposal.

B I'm sorry, I just haven't had time. I'll get it finished this afternoon and let you have it tomorrow

Pronunciation – Showing disbelief

1 **A** How much water will it save?
B Calum said it would save 30%.
C How much water will it save?
D Calum said it would save 30%.

Listening – Cleaning water

Well, we all need water and today I'd like to discuss how it's cleaned before it's piped into homes and offices. In Europe and North America, water comes from different sources, mainly lakes, aquifers, or rivers. Rivers are usually dammed to form reservoirs. But before they reach our homes, most of our water supplies have to be purified. This takes place in a water treatment works where impurities are removed to make the water clear, odour-free, and taste-free. So it should be perfectly transparent, smell of nothing, and taste of nothing.

First of all, water taken from a river or reservoir is screened to remove large bits of rubbish such as twigs, plastic bags, etc. This is done by passing it through a microstrainer. Then, it's pumped to a water treatment works. At this stage, grit and organic matter, for example pieces of plants, algae, and bacteria, are still present in the water. The water is fed into an aerator, which sprays the water in order to obtain a good oxygen balance. At the same time, this spraying releases any trapped gases that might otherwise give a bad taste or odour. Following this, chemicals called coagulants are added. The function of these is to cause particles to stick together to form larger particles. The chemical normally used is alum, aluminium sulphate. This takes place in large tanks called flash mixers.

From here, the water passes into a sedimentation tank, sometimes called a settling basin. Here, the large particles are allowed to settle to the bottom. A sludge builds up at the bottom of the tank and has to be removed and treated. By this stage, about 85% of all suspended matter has been removed so the water is now relatively clean and clear.

The next step is filtration, normally in a rapid sand filter. Water is fed in at the top. It passes first of all through a layer of carbon or anthracite coal and then through layers of sand. The carbon removes any remaining organic compounds that would affect the taste or odour and the sand removes any remaining particles.

The final step is the addition of chemicals to disinfect the water in large disinfection tanks. Usually, some form of chlorine is used to kill any pathogens – that's viruses or bacteria. Some processes use ozone. Disinfection not only kills pathogens in the treated water but also helps to protect against any new contamination from pipes and storage tanks. In some places, fluoride is also added to prevent tooth decay in a process known as fluoridation.

The water is now fit to drink and can be pumped directly to homes, offices, and factories.

Unit 11

Problem-solving

I am going to tell you about the five sensors that our domestic robotic vacuum cleaner contains. These sensors help it to navigate safely and to clean surfaces effectively.

The dimension sensors determine the size of the room. The robot cleaner sends an infrared signal in each direction in turn. These reflect from the walls and return to an infrared receiver. The processor calculates the dimensions of the room from the time taken for the signal to return.

Then there are object sensors – when the cleaner hits an object, such as a chair, the bumper, which goes right round the cleaner, is pressed in. This activates mechanical object sensors. These send signals to the processor which cause the cleaner to change direction to avoid the object.

There are also cliff sensors – under the cleaner there are infrared sensors directed downwards. If the time taken for the return infrared signal increases suddenly, the processor detects a 'cliff', for example, stairs or other sudden drops which the robot could fall down. This causes the robot to reverse away from the cliff.

The wall sensors let the cleaner follow walls and go round objects closely but without touching them.

And finally, and most importantly, dirt sensors – these are acoustic impact sensors. When the cleaner raises a lot of dirt from a carpet or other surface, some of the dirt hits the metal plates of the acoustic impact sensors. This causes vibration which the sensors detect. They pass a signal to the processor which causes the robot to clean the area again until there are no more vibrations – in other words, until the area is clean.

It's my job

I = Interviewer, J = Jaako Ikonen

I How did you get interested in technology?
J I started making radio-controlled model boats at the age of 13.
I That's how you got started?
J That's how I got started, yeah. I loved playing around with the electronics.
I Did you go on to college at the end of school?
J Yes, I went to college and did Mechanical engineering with one year of Electrical and electronic engineering.
I What was your first job?
J Designing and building automated manufacturing systems for a mobile phone company. They needed to automate because production was going through the roof. Their old system simply could not produce enough phones.
I I'm not clear about the distinction between mechanization and automation.
J Big difference. Mechanization is the old world of machines with no brains, they could do only one thing – like Henry Ford's assembly lines. Automation means you are using a combination of software, of mechanical engineering, electronics, electrical engineering – that's the mechatronics side of things. There's intelligence built in. That's why it's called automation.
I You then moved to your current job?
J Yes. I'm Senior Manufacturing Systems Engineer for a large health care company. That means I'm responsible for developing all new processes and process automation for manufacturing our products.
I What do you make?
J One of the main products is blood glucose monitors for diabetics. It uses biosensors, which are coated in enzymes to measure the blood glucose levels in a drop of blood. Basically how much sugar there is in the blood.
I Where does automation come in?
J You can't make these machines by hand. There can't be any contamination, they have to be perfectly clean, and there can't be any defects in the production. Peoples' lives are involved so you cannot afford to be wrong. Also the volume is huge so only machines can achieve this.
I Is it done by robots?
J We use incredibly fast, vision-driven robots. They don't simply pick up and place components blindly. They can see what they're doing, they can teach themselves, and they check every move they make to ensure there are no errors.
I What qualities do you need to be successful in your field?
J You must be innovative. You must be able to work across functions and be able to communicate with non-technical people.
I Can you give me any examples of communicating with non-technical people?
J I work in R&D and we have to constantly communicate with Marketing – they know what the customers want. We just have the ideas.

I They seem to be great ideas. Thanks very much for your time.

J A pleasure, thank you.

Unit 12

It's my job

When I left school I did an apprenticeship in Cabinet making. I was quite good at this and I enjoyed it so I went to university to study Wood technology and Business and then decided to set up my own company. I'm the Managing Director but as there are only five of us, I spend my time designing kitchens as well as running the company.

My company specializes in designing and installing kitchen units. We are finding that our customers want more and more high-tech appliances in their kitchens so my job involves a lot more than putting in cupboards and hanging doors.

I really like the changing technology used in kitchen appliances. Nowadays, cookers are no longer simple appliances. Using different technology, most modern ovens are self-cleaning. One company called Kuppersbusch has developed a catalytic system. The way it works is that the oven fan blows air from the oven through a catalytic converter which changes fat and food residue into water and carbon dioxide.

On top of the cooker, conventional hobs heat the ring which in turn heats the cooking pot. But modern induction hobs use magnetic induction to heat the metal base of the pot They heat much more quickly than conventional electric rings, save energy, and are safer. The problem is that the pots must be magnetic – made of steel. People can't use aluminium pots or pots with a thick copper base.

Another feature of the modern kitchen is electronic entertainment systems. It's possible to install flip-down flat screens that can be used for watching TV or as a computer monitor to access the Internet for recipes. They can even be linked to security cameras.

The smart kitchen is on its way and I am doing everything to make sure my company is able to provide our customers with the kitchens of the future. The best place to follow the latest technologies is the Massachusetts Institute of Technology, they've got a section called Counter Intelligence. It's a department dedicated to inventing new gadgets and gizmos for the kitchen. Their current projects include an electronic spoon that teaches you how to cook!

Pronunciation – Polite requests

A Could you tell me how this oven works, please?

B Could you tell me how this oven works, please?

1 I wonder if you could send me a catalogue.
2 I'd like you to use solid wood for the units.
3 Could you set up the machine?
4 Would you mind changing the height?
5 Could you tell me what happens next?
6 Would you mind cleaning up the mess?
7 I'd like you to calculate the angle carefully.
8 I wonder if you could help me.

Listening – Refrigerator

L = Lecturer, S1 = student 1, S2 = student 2, S3 = student 3

L What do you feel when you put water on your skin?

S1 It feels cool

L Yes, it makes you feel cool because the water absorbs heat from your skin as it evaporates. So, evaporation cools the surrounding area. Putting alcohol on your skin feels even cooler because alcohol has a lower boiling point than water, so evaporates at a lower temperature. In a fridge, we use a different liquid, called a refrigerant which evaporates at a very low temperature. So, this is how a fridge works. Really, it's the compressor that powers the whole process. It compresses the refrigerant. Can anyone tell me what happens when a gas is compressed?

S2 There's a rise in the temperature and pressure.

L Quite right! The heat-exchanging coils are positioned outside the fridge, so that this heat is lost to the surrounding area and as it cools, the gas condenses into a liquid. The liquid then flows through the expansion valve. This expansion valve reduces the pressure. As a result, the refrigerant expands and evaporates and then goes back inside the fridge. As we said earlier, evaporation absorbs heat. So, heat-exchange pipes inside the fridge allow heat to be absorbed and this makes the space feel cold. As the refrigerant leaves the fridge, it once again enters the compressor and the whole cycle starts again.

S3 Why do old refrigerators get ice on the freezer box?

L Well, that's because water vapour from food in the fridge condenses, but as it hits, the very cold icebox, the liquid water changes immediately to ice. But modern fridges are frost-free. They have a heating coil beside the freezer coils. It's switched on by a timer, once every six or seven hours. Then, a temperature sensor detects the rising temperature when all the ice around the freezer coils has melted, and switches the heater off. That way, there is no build-up of ice but of course the temperature in the fridge fluctuates slightly

Unit 13

Listening – The future of defence

Presenter
The search for military superiority has been one of the driving forces in technology from the creation of the first weapons to the development of the nuclear bomb. I am joined by Francis Hodges and Giles Wigg-Smith, who are both Defence Analysts, to present two different views on the future of defence technology

Francis Hodges
For countries with access to high technology, military strength will depend less on the number of soldiers, aircraft, and ships and more on the capacity and speed of their military computer networks. Constantly updated intelligence on the position and strength of the opposition is the key to success. Information will be fed into the network from UAVs, uncrewed aerial vehicles, robotic sensors, and robotic seekers which will act as scouts locating enemy positions. The soldier in the field as well as commanders at a distance will be linked into the network so that everyone is well-informed at all times.

The hardware used will be smaller and lighter so it can be moved easily by transport aircraft from one position to another. Many of the vehicles used will be unmanned and will have camouflage paint which can change its colour according to its location. The weapons will be smarter. Missiles will be programmed with target details and capable of staying in the air until the target is confirmed. There should be less damage to people and property.

Giles Wigg-Smith
I'm not totally convinced by this. There are problems with high-tech systems. Very complex electronics can fail. The transfer rate, a hundred megabytes per second, required to handle this much data is greater than anything we have to date. Any network is vulnerable to hackers. Your system could be turned against you by feeding false information into the network, or a virus could be introduced to cripple the system.

High-tech armies are vulnerable to low-tech weapons: a plane can be brought down by rifle fire; improvised devices can destroy armoured vehicles. A system designed to destroy the electronics of incoming missiles can't protect against such simple weapons.

Many conflicts today are policing operations in situations where there are large numbers of civilians present. These high-tech systems are designed for wars rather than peace-keeping operations like this. Often these operations involve soldiers from a number of countries working together under a UN mandate but if you don't share the same system as your allies, you can't fight together as a unified force and it's unlikely countries will wish to share technical secrets with each other.

Unit 14

It's my job

I = Interviewer, B = Brian

I Brian, how did you get interested in electronics?

B At school. The History Teacher was a radio amateur. He started an after-school electronics club. He showed us how to make simple radios, multimeters, that sort of thing. I learned more from him than the Physics Teacher. Another reason I was interested was one of my friends built model aircraft, large things with a wingspan well over a metre, and I used to make the transmitters and receivers for radio control. If you forgot to switch on the receiver, the plane flew off into the distance until the fuel ran out. That happened more than once.

I What did you do after school?

B I took a certificate course in Electronics at the local college.

I What subjects did you study?

B I can't remember them all. Ehh, DC and AC circuits, Solid state devices, Applied maths.

I All technical subjects?

B Yes, apart from Technical communications. That's speaking and writing about technology. About half the time was spent in the lab, which was good. I liked the practical side. We had time to work on a project of our own. I designed a device to tell people who were fishing when a fish was biting the bait.

I What did you do when you finished college?

B With another student I started my own company repairing computers and other electronic items. But we gave it up after a couple of years. The price of things like DVD-players kept falling. It became cheaper to buy new than have them repaired.

I What kind of work do you do now?

B I work for the Northern Lighthouse Board. I help look after communications equipment at headquarters and in lighthouses as well as navigation equipment on buoys and radio beacons. There's not much on a buoy – just a light and a radar reflector. We also look after the transmission stations for the Marine GDPS. There are four in Scotland.

I What's the Marine GDPS?

B It's the Marine Global Differential Positioning System. It's a system which allows ships to plot their position very accurately.

I How is it different from GPS?

B It combines GPS signals with land-based signals to give a really accurate position. It's important in busy shipping lanes.

I What's the best part of your job?

B All the lighthouses are automated now. There are no lighthouse keepers these days. We monitor them 24 hours a day to make sure everything's working. When something goes wrong, you have to go out there and fix it. Some of them are quite remote. That can mean a helicopter ride in winter out into the Atlantic. I love going to places that very few people have ever visited, including the Flannan Isles.

I What will you do next?

B I like this job too much to think of looking for something else.

Pronunciation – Reading component values

a ten-microfarad electrolytic capacitor
a five-hundred-picofarad variable capacitor
a ten-kilohm variable resistor
a nine-volt battery
a one-milliamp milliammeter
a sixty-microhenries inductor
a six-volt sixty-milliamp bulb

Unit 15

Listening – Interview with a Network Designer

I = Interviewer, S = Sami

I Tell me a little about your professional history and what you do now.

S At school I used to enjoy Maths and Physics, so when I left school at sixteen I wanted a job working in technology, and outdoors if possible. I got good marks in my school exams. A friend told me that BT had an apprenticeship scheme, so I applied. There was an interview and I was accepted. I was seventeen and a Service Technician, climbing poles and fixing lines. It was great. BT is a company that is constantly changing and there are always opportunities to study and learn new things. I passed my BTEC in Telecommunications with 100%!

At eighteen I became a Data and Networks Technician and studied for an NVQ. It was my job to install new networks at the exchanges. I was responsible for the exchange switch and transmission. I was out on work placements a lot to get experience and did loads of courses. We got days off work to study.

I got more and more interested in actually designing the network. The new 21st-Century Network was about to be developed so I decided to become a Network Designer when I was twenty, and joined the Network Design Department. The 21st-Century Network was to be a completely new IT network to replace the old phone-based one. It was a massive challenge to BT. In the office I learned how to design and plan networks as well as how to predict future growth and trends using modelling techniques. At the same time the company sponsored me to do a university degree. Now I was designing the systems that BT's technology runs on. When I was 23 I graduated from university with a BSc in Computer and network engineering and have worked as a Network Designer since then. I've worked as Project Manager on a range of really interesting projects. I've had to learn different skills really quickly and learn how to prioritize. New projects make you think about what exactly needs to be done and which parts are important. I have to give presentations to senior management within the company, major customers, and at international conferences.

Glossary

Vowels

iː	media	ʊ	goods	aɪ	high-tech
	ability		lubricate		outer
	impact		well-insulated		spoilers
e	reservoir	ʌ	oven	ɪə	pier
	amplify		turbine		aeronautical
ɑː	barge	ə	sewer	ʊə	durable
ɒ	cockpit	eɪ	radar		
ɔː	platform	əʊ	sonar		

Consonants

p	panel	f	filtration	h	hacker
b	bacteria	v	vessel	m	modulate
t	track	θ	stealth	n	navigate
d	diode	ð	deal with	ŋ	wingspan
k	cable	s	span	l	lift
g	grain	z	carbon emissions	r	rig
tʃ	switch	ʃ	shear	j	yield
	generator		decision maker		welded

ability /əˈbɪləti/ *n* having the skill and intelligence to do a particular job

access /ˈækses/ *n* a way of entering a place

accommodation /əˌkɒməˈdeɪʃn/ *n* a place to live or stay in

accuracy /ˈækjərəsi/ *n* the quality of being exact or correct

acoustic /əˈkuːstɪk/ *adj* (used about a sensor, etc.) responding to sound or vibrations

activate /ˈæktɪveɪt/ *v* to make a device start working

adaptable /əˈdæptəbl/ *adj* able to be changed in order to deal with new situations

aeronautical /ˌeərəˈnɔːtɪkl/ *adj* relating to the study or practice of building and flying aircraft

amplify /ˈæmplɪfaɪ/ *v* to increase the strength of a signal or an electrical wave

apologize /əˈpɒlədʒaɪz/ *v* to say sorry for doing something wrong or causing a problem

appliance /əˈplaɪəns/ *n* a machine designed to do a task in the home, such as preparing food, cleaning, etc.

applicant /ˈæplɪkənt/ *n* a person who applies for a job

application /ˌæplɪˈkeɪʃn/ *n* a formal written request for a job

apply /əˈplaɪ/ *v* to make a formal written request for a job

apprentice /əˈprentɪs/ *n* a young person who works for an employer for a fixed period of time to learn the particular skills needed in the job

approach /əˈprəʊtʃ/ *v* to move closer to something

armoured /ˈɑːməd/ *adj* (used about a military vehicle) protected by metal covers

assembly /əˈsembli/ *n* the process of putting parts together in order to make something

attach to /əˈtætʃ tə/ *v* to fasten or join to something

attendance record /əˈtendəns ˌrekɔːd/ *n* an account of how often someone has been present at or absent from their work

automation /ˌɔːtəˈmeɪʃn/ *n* the use of machines to do work that was previously done by people

bacteria /bækˈtɪəriə/ *n* very small living things, made of a single cell

barbed wire /ˌbɑːbd ˈwaɪə(r)/ *n* strong wire with short sharp points on it, used for fences

barge /bɑːdʒ/ *n* a large boat with a flat bottom, used for transporting things on canals and rivers

biodegradable /ˌbaɪəʊdɪˈgreɪdəbl/ *adj* able to be broken down by bacteria and not damage the environment

bit /bɪt/ *n* the cutting part of a drill

cable /ˈkeɪbl/ *n* thick, strong metal rope, used for supporting bridges

candidate /ˈkændɪdət; -deɪt/ *n* a person who is applying for a job

canning /ˈkænɪŋ/ *n* the process of putting food or drink in cans

capacitor /kəˈpæsɪtə(r)/ *n* a device used to store an electrical charge

Glossary

carbon emissions /ˌkɑːbən iˈmɪʃnz/ *n* harmful gases containing carbon, that are sent out into the air
cargo /ˈkɑːɡəʊ/ *n* the goods carried on a ship or aircraft
caterpillar tracks /ˈkætəpɪlə ˌtræks/ *n* metal belts fastened around the wheels of a vehicle or robot so that it can travel over rough or soft ground
cellulose /ˈseljuləʊs/ *n* a substance that forms the walls of plant cells and which is used in making plastics
cockpit /ˈkɒkpɪt/ *n* the area at the front of a plane where the pilot sits
collapse /kəˈlæps/ *v* (used about a building, etc.) to fall down or fall in suddenly
commercially viable /kəˌmɜːʃəli ˈvaɪəbl/ *adj* (used about a business plan, etc.) capable of making a profit
component /kəmˈpəʊnənt/ *n* one of the parts of a device or machine
compression /kəmˈpreʃn/ *n* the act of pressing or squeezing something into a smaller space
condensation /ˌkɒndenˈseɪʃn/ *n* water that forms on a cold surface when steam or warm air becomes cool and changes into a liquid
conduct /kənˈdʌkt/ *v* (used about a substance) to allow heat or electricity to pass along it
confirm /kənˈfɜːm/ *v* to state that something is definitely true or correct
congestion /kənˈdʒestʃən/ *n* the state of being crowded and full of traffic
constituent /kənˈstɪtjuənt/ *n* one of the parts of something that combine to form the whole
construct /kənˈstrʌkt/ *v* to build or make something
consumer /kənˈsjuːmə(r)/ *n* a person who buys goods or uses services
container ship /kənˈteɪnə ˌʃɪp/ *n* a ship designed to transport goods that are packed in large metal boxes (= containers)
contamination /kənˌtæmɪˈneɪʃn/ *n* the presence of dirty or harmful substances in food, water, etc.
convert /kənˈvɜːt/ *v* to change something from one form to another
converter /kənˈvɜːtə(r)/ *n* a device that changes one form of energy to another form
convertible /kənˈvɜːtəbl/ *adj* able to be changed to a different form or use
countermeasure /ˈkaʊntəmeʒə(r)/ *n* a course of action taken to protect against something bad or dangerous
covering letter /ˌkʌvərɪŋ ˈletə(r)/ *n* a letter that you send with something to give extra information
crop /krɒp/ *n* a plant that is grown in large quantities for food
current /ˈkʌrənt/ *n* the flow of electricity through a wire
deal with /ˈdiːl wɪð/ *v* to take action to solve a problem
decision maker /dɪˈsɪʒn ˌmeɪkə(r)/ *n* a person who can make difficult or important decisions
degree /dɪˈɡriː/ *n* the qualification obtained by students who successfully complete a university course
dehydration /ˌdiːhaɪˈdreɪʃn/ *n* the process of removing the water from something
diode /ˈdaɪəʊd/ *n* an electronic device which allows electric current to pass in one direction only
dispose of /dɪˈspəʊz əv/ *v* to get rid of something that you do not want
distortion /dɪˈstɔːʃn/ *n* a change in the shape or structure of something that makes it less efficient, less strong, etc.
drag /dræɡ/ *n* the force of the air that acts against the movement of an aircraft
drawer /drɔː(r)/ *n* a part of a piece of furniture such as a desk, that slides in and out and is used for keeping things in
drill /drɪl/ *n* a tool or machine used for making holes
durable /ˈdjʊərəbl/ *adj* able to last for a long time without breaking or getting weaker
earn money /ˌɜːn ˈmʌni/ *v* to receive money for working
energy-saving /ˈenədʒi ˌseɪvɪŋ/ *adj* (used about a machine, etc.) using less energy than is usual
environment /ɪnˈvaɪrənmənt/ *n* the natural world in which people, animals, and plants live
environmental /ɪnˌvaɪrənˈmentl/ *adj* connected with the natural world and the effect of human activity upon it
environmental impact /ɪnˌvaɪrənmentl ˈɪmpækt/ *n* the effect that a particular action will have on the environment
evaporate /ɪˈvæpəreɪt/ *v* (used about a liquid) to change into a gas
exert /ɪɡˈzɜːt/ *v* to put force or pressure on something
explosive /ɪkˈspləʊsɪv/ *n* something that could cause an explosion
extreme /ɪkˈstriːm/ *adj* (used about physical conditions) not ordinary or usual; serious or severe
fascinating /ˈfæsɪneɪtɪŋ/ *adj* extremely interesting
fermentation /ˌfɜːmenˈteɪʃn/ *n* a process in which a substance is chemically broken down by bacteria, etc., during which alcohol is produced
filtration /fɪlˈtreɪʃn/ *n* the process of passing a liquid through a filter (= a device that removes any materials that are not wanted)
find faults /faɪnd ˈfɔːlts/ *v* to find things that stop a machine from working correctly
flaps /flæps/ *n* a part of the wing of a plane that can be moved up or down to control upward movement
flue gas treatment /ˌfluː ɡæs ˈtriːtmənt/ *n* a process for removing harmful substances from the smoke that is produced by factories
fossil fuel /ˈfɒsl ˌfjuːəl/ *n* fuel such as coal or oil, formed from the remains of animals or plants
foundations /faʊnˈdeɪʃnz/ *n* the solid base of a building

frequency /ˈfriːkwənsi/ *n* the rate at which a sound or an electrical wave moves up and down

gearbox /ˈɡɪəbɒks/ *n* a metal case containing the gears of a vehicle; the system of gears of a vehicle

germinate /ˈdʒɜːmɪneɪt/ *v* (used about the seed of a plant) to start to grow

global warming /ˌɡləʊbl ˈwɔːmɪŋ/ *n* the increase in the temperature of the earth's atmosphere, caused by increased amounts of gases such as carbon dioxide

goods /ɡʊdz/ *n* things that are made to be sold

grain /ɡreɪn/ *n* the seeds of food plants, such as corn or rice

hacker /ˈhækə(r)/ *n* a person who gains access to a computer system without permission in order to steal data, etc.

harvesting /ˈhɑːvɪstɪŋ/ *n* the act of cutting and gathering crops

high-tech /ˌhaɪ ˈtek/ *adj* using the most modern electronic technology

hinge /hɪndʒ/ *n* a movable joint on a door, or lid, by which it opens or closes

hull /hʌl/ *n* the main, bottom part of a ship, that goes in the water

hydraulic system /haɪˈdrɒlɪk ˌsɪstəm/ *n* a mechanical system that is operated by liquid moving under pressure through an arrangement of cylinders and pistons

hydrocarbon /ˌhaɪdrəˈkɑːbən/ *n* a chemical made up of hydrogen and carbon, that is found in petrol, coal, and natural gas

immerse /ɪˈmɜːs/ *v* to put something into a liquid so that it is covered completely

impact /ˈɪmpækt/ *n* the act of one object hitting another; the force with which this happens

impurities /ɪmˈpjʊərətiz/ *n* substances that are present in small amounts in another substance, making it dirty or of poor quality

induce /ɪnˈdjuːs/ *v* to produce an electric current

infrared /ˌɪnfrəˈred/ *adj* using electromagnetic waves which are longer than those of red light

inner /ˈɪnə(r)/ *adj* on the inside of something

irrigation /ˌɪrɪˈɡeɪʃn/ *n* the process of supplying water to an area of land so that crops will grow

know-how /ˈnəʊ haʊ/ *n* knowledge and experience of how to do something

landing gear /ˈlændɪŋ ˌɡɪə(r)/ *n* the wheels and other parts of an aircraft that support it when it is on the ground

lift /lɪft/ *n* the upward pressure of air on an aircraft when it is flying

lining /ˈlaɪnɪŋ/ *n* a layer of material used to cover the inside surface of something

location /ləʊˈkeɪʃn/ *n* the place where something exists or happens

lower /ˈləʊə(r)/ *v* to make something go down

lubricate /ˈluːbrɪkeɪt/ *v* to put oil, grease, etc. on the parts of a machine so that they move smoothly

magnetic /mæɡˈnetɪk/ *adj* able to attract iron objects towards it

marketing /ˈmɑːkɪtɪŋ/ *n* the activity of presenting, advertising, and selling a company's products

media /ˈmiːdiə/ *n* the main forms of public communication, such as TV, radio, newspapers, etc.

minimize /ˈmɪnɪmaɪz/ *v* to reduce something to the lowest possible level

modulate /ˈmɒdjuleɪt/ *v* to change the characteristics of a signal or a wave, by altering its frequency, amplitude, etc.

molecule /ˈmɒlɪkjuːl/ *n* the smallest group of atoms into which a substance can be divided without changing its chemical nature

motorway /ˈməʊtəweɪ/ *n* a wide road, with several lanes in each direction, where traffic can travel fast for long distances

movable /ˈmuːvəbl/ *adj* able to be moved from one place or position to another

multitasking /ˌmʌltiˈtɑːskɪŋ/ *n* the ability to do several different things at the same time

navigable /ˈnævɪɡəbl/ *adj* (used about a path or an area of land) that a robot can move across without falling over, etc.

navigate /ˈnævɪɡeɪt/ *v* to find and follow a path through an area

non-lethal /ˌnɒnˈliːθl/ *adj* not causing death

offshore /ˌɒfˈʃɔː(r)/ *adv* in the sea, not far from the land

opportunity /ˌɒpəˈtjuːnəti/ *n* a chance to do something

oscillator /ˈɒsɪleɪtə(r)/ *n* an electrical device that produces an alternating current (= electrical current that changes direction many times a second)

outer /ˈaʊtə(r)/ *adj* on the outside of something

oven /ˈʌvn/ *n* a large device shaped like a box with a door on the front, in which food is cooked

packaging /ˈpækɪdʒɪŋ/ *n* materials used to wrap or protect goods that are sold in shops

panel /ˈpænl/ *n* a flat piece of wood, glass, or metal that forms part of a door, wall, etc.

paperwork /ˈpeɪpəwɜːk/ *n* the part of a job that involves writing letters, filling in forms, etc.

parallel to /ˈpærəlel tə/ *adv* in a straight line, while maintaining an equal distance from another object or surface

passenger /ˈpæsɪndʒə(r)/ *n* a person who is travelling in a vehicle

pasteurization /ˌpɑːstʃəraɪˈzeɪʃn/ *n* the process of heating and then cooling a liquid, such as milk, in order to kill harmful bacteria

pier /pɪə(r)/ *n* a column or a support for a bridge

pigment /ˈpɪɡmənt/ *n* a substance that adds colour to something

pitching /ˈpɪtʃɪŋ/ *n* the upward and downward movement of the front of a plane

plasticizer /ˈplæstɪsaɪzə(r)/ *n* a substance added to a plastic so that it becomes easy to bend

platform /ˈplætfɔːm/ *n* a large raised structure in the sea that provides a base for a rig when drilling for oil

power source /ˈpaʊə ˌsɔːs/ *n* the place or device that supplies the electrical energy for something

preservation /ˌprezəˈveɪʃn/ *n* the process of treating food so that it does not rot or decay

pressurize /ˈpreʃəraɪz/ *v* to increase the pressure inside something

production costs /prəˈdʌkʃn kɒsts/ *n* the amount of money that a business needs to spend in order to make something

program /ˈprəʊgræm/ *v* to give a computer a set of instructions to make it do a particular task

project /ˈprɒdʒekt/ *n* a planned piece of work that is designed to produce something new

promotion /prəˈməʊʃn/ *n* a move to a more important job or position in a company

proposed /prəˈpəʊzd/ *adj* (used about a plan, etc.) suggested for people to think about and decide on

public transport /ˌpʌblɪk ˈtrænspɔːt/ *n* a system of buses, trains, etc. which people use to travel from one place to another

pulse /pʌls/ *n* a single short increase in the amount of energy, electricity, etc. produced by a device

qualification /ˌkwɒlɪfɪˈkeɪʃn/ *n* an exam or a course of study that you have successfully completed

qualified /ˈkwɒlɪfaɪd/ *adj* having the necessary qualifications to do a particular job

quality assurance /ˈkwɒləti əˌʃʊərəns/ *n* the practice of making sure that goods or services are kept at a high standard

radar /ˈreɪdɑː(r)/ *n* a system that uses radio waves to find the position and movement of planes, ships, etc.

rail /reɪl/ *n* one of the two metal bars that form the track that trains run on

raise /reɪz/ *v* to lift or move something to a higher level

raw materials /ˌrɔː məˈtɪəriəlz/ *n* basic materials that are used to make a product

recommend /ˌrekəˈmend/ *v* to advise a particular course of action

reference /ˈrefrəns/ *n* a statement that is written by someone who knows you, giving information about your character and skills

refine /rɪˈfaɪn/ *v* to make a substance pure by taking other substances out of it

refrigerant /rɪˈfrɪdʒərənt/ *n* a substance used in cooling devices, such as fridges and freezers

refrigeration /rɪˌfrɪdʒəˈreɪʃn/ *n* the process of making something cold in order to preserve it

reinforced concrete /ˌriːɪnfɔːst ˈkɒŋkriːt/ *n* concrete with metal bars or wires inside to make it stronger

relay /ˈriːleɪ/ *n* a device, usually containing an electromagnet, which is made active by a flow of current in one circuit in order to open or close another circuit

remediation /rɪmiːdɪˈeɪʃən/ *n* the removal of harmful chemicals and industrial waste from an area of land

remind /rɪˈmaɪnd/ *v* to help somebody remember to do something

renewable energy /rɪˈnjuːəbl ˌenədʒi/ *n* energy, such as wind and wave energy, which is replaced naturally

reservoir /ˈrezəvwɑː(r)/ *n* a natural or an artificial lake, used as a store of water

resist /rɪˈzɪst/ *v* to not be damaged by something

resistor /rɪˈzɪstə(r)/ a device that reduces the flow of current in an electronic circuit

responsibility /rɪˌspɒnsəˈbɪləti/ *n* the duty of being in charge of a particular activity

rig /rɪg/ *n* a large piece of equipment, used for taking oil or gas from the ground or under the sea

rolling /ˈrəʊlɪŋ/ *n* the movement of a plane in which one wing rises while the other wing falls

rotor /ˈrəʊtə(r)/ *n* a part of a machine which turns around, for example one of the blades of a helicopter

seabed /ˈsiːbed/ *n* the floor of the ocean

seed /siːd/ *n* a small hard part produced by a plant, from which a new plant can grow

self-sufficient /ˌself səˈfɪʃnt/ *adj* able to produce everything that you need without the help of other people

sensory system /ˈsensəri ˌsɪstəm/ *n* the equipment in a robot that notices changes in the environment, concerning heat, light, pressure, etc.

sewage /ˈsuːɪdʒ/ *n* waste matter produced by human bodies and carried away through sewers

sewer /ˈsuːə(r)/ *n* an underground pipe, used for carrying away waste matter from human bodies

shear /ʃɪə(r)/ *n* movement in which two surfaces slide past each other; the force or pressure that causes this to happen

shore-based /ˈʃɔːbeɪst/ *adj* done or happening on land rather than at sea

skill /skɪl/ *n* a particular ability

skilled /skɪld/ *adj* having the ability, knowledge, and experience to do something well

sonar /ˈsəʊnɑː(r)/ *n* a system for finding objects underwater using sound waves

span /spæn/ *n* the part of a bridge between one vertical support and another; the distance between these supports

spoilers /ˈspɔɪləz/ *n* parts of a plane's wing that can be raised in order to interrupt the flow of air over it and reduce lift

stabilizers /ˈsteɪbəlaɪzəz/ *n* devices that keep an aircraft level and stop it from rolling to one side

statistics /stəˈtɪstɪks/ *n* collections of information shown in numbers

stealth /stelθ/ *adj* (used about an aircraft, a ship, etc.) designed with technology that prevents it from being seen by radar, sonar, etc.

structure /ˈstrʌktʃə(r)/ *n* a thing that is made of several parts, such as a building

suggest /səˈdʒest/ *v* to recommend something that may be suitable for a particular purpose

suspension bridge /səˈspenʃn ˌbrɪdʒ/ *n* a bridge that hangs from steel cables that are fixed to towers at each end

switch /swɪtʃ/ *n* a device that opens or closes an electric circuit

team /tiːm/ *n* a group of people who work together at a particular job

tension /ˈtenʃn/ *n* the state of being pulled tight

thermoplastic /θɜːməʊˈplæstɪk/ *n* a type of plastic that can be melted and cooled repeatedly without becoming different in quality

thermoset /ˈθɜːməʊset/ *adj* (used about a type of plastic) treated so that it will not melt or become soft again when heated

thrust /θrʌst/ *n* the force produced by an engine that pushes a plane forward

tolerance /ˈtɒlərəns/ *n* the amount by which a value or measurement is permitted to vary

trailing edge /ˌtreɪlɪŋ ˈedʒ/ *n* the thin, rear edge of a wing

transformer /trænsˈfɔːmə(r)/ *n* a device used for changing the voltage of an electrical current

transistor /trænˈzɪstə(r)/ *n* an electronic device, used in computers, radios, etc., which controls current by acting as a switch or as an amplifier (= a device for increasing an electrical signal)

transmit /trænsˈmɪt/ *v* (used about a device or substance) to allow heat, energy, etc. to pass through

trigger /ˈtrɪɡə(r)/ *v* to cause a device to start functioning

turbine /ˈtɜːbaɪn/ *n* a motor with blades that are turned around by the air, water, etc. in order to generate electricity

uncrewed /ˌʌnˈkruːd/ *adj* (used about an aircraft, etc.) without any people on board to operate it

underground /ˈʌndəɡraʊnd/ adj under the surface of the ground

unmanned /ˌʌnˈmænd/ *adj* (used about an aircraft, etc.) without a person on board to operate it

ventilation /ˌventɪˈleɪʃn/ *n* the flow of air in and out of a room or building

versatile /ˈvɜːsətaɪl/ *adj* (used about a material) able to be used for many different purposes

vessel /ˈvesl/ *n* a ship or a boat

vibrate /vaɪˈbreɪt/ *v* to move from side to side very quickly and with small movements

visible /ˈvɪzəbl/ *adj* able to be seen

warship /ˈwɔːʃɪp/ *n* a ship used in war

waste /weɪst/ *n* material that is no longer needed and is thrown away

water purification /ˈwɔːtə pjʊərɪfɪˌkeɪʃn/ *n* the process of making water clean by removing substances that are dirty, harmful, etc.

wave /weɪv/ *n* a raised line of water that moves across the surface of the sea, etc.

weaken /ˈwiːkən/ *v* to make something less strong

welded /ˈweldɪd/ *adj* (used about two pieces of metal, etc.) joined together by heating the edges and pressing them together

well-insulated /ˌwel ˈɪnsjuleɪtɪd/ *adj* (used about a house, room, etc.) protected with a material that reduces the loss of heat, sound, etc. as far as possible

wind /wɪnd/ *n* the natural movement of the air

wingspan /ˈwɪŋspæn/ *n* the distance from the end of one wing to the end of the other

work experience /ˈwɜːk ɪkˌspɪəriəns/ *n* the work or jobs that you have done in your life so far

wrapping /ˈræpɪŋ/ *n* paper, plastic, etc. used for covering something in order to protect it

yawing /ˈjɔːɪŋ/ *n* the movement of a plane in which it turns to one side, away from a straight course

yield /jiːld/ *n* the total amount of crops, etc. that is produced